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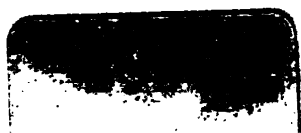
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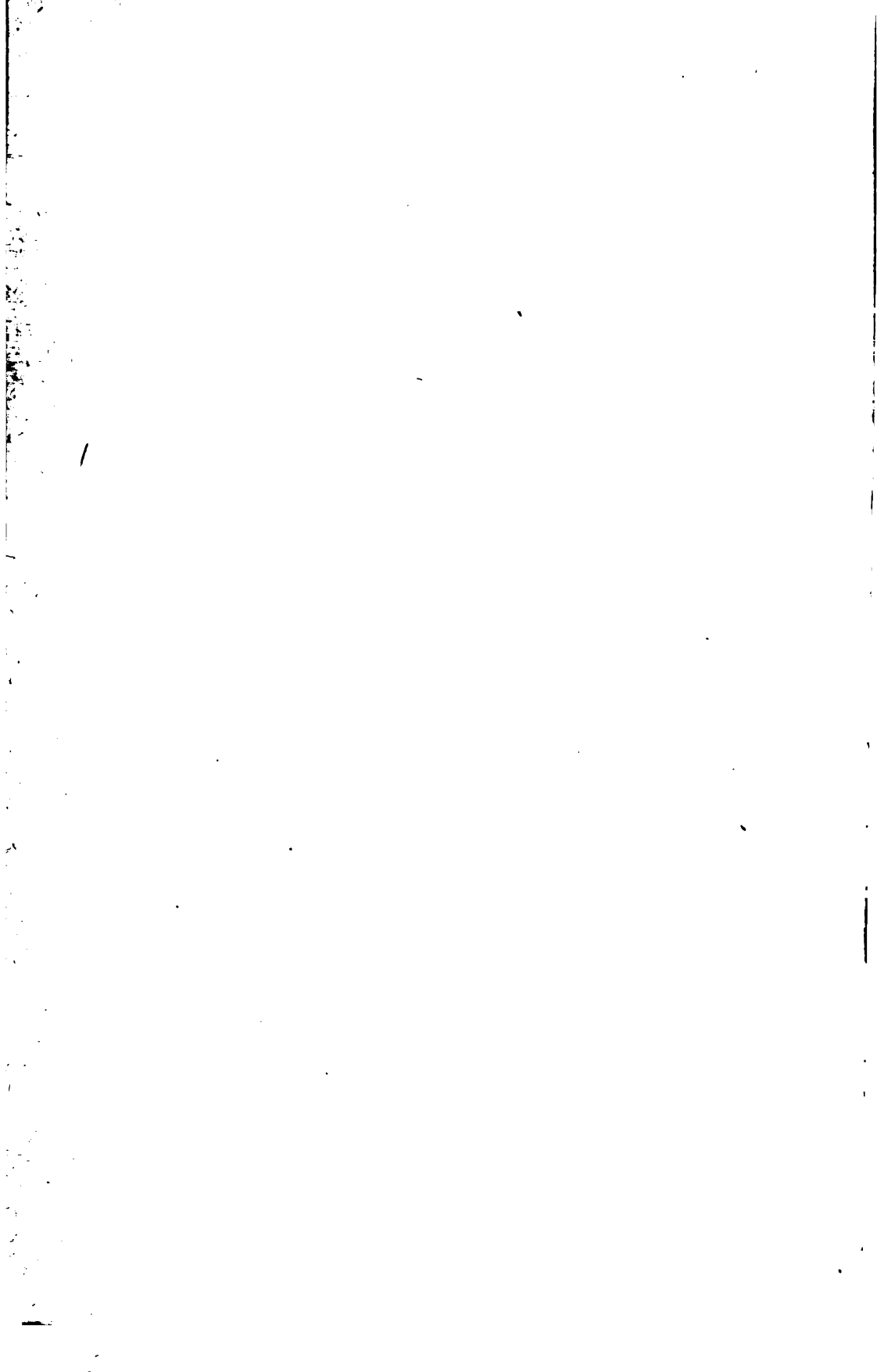
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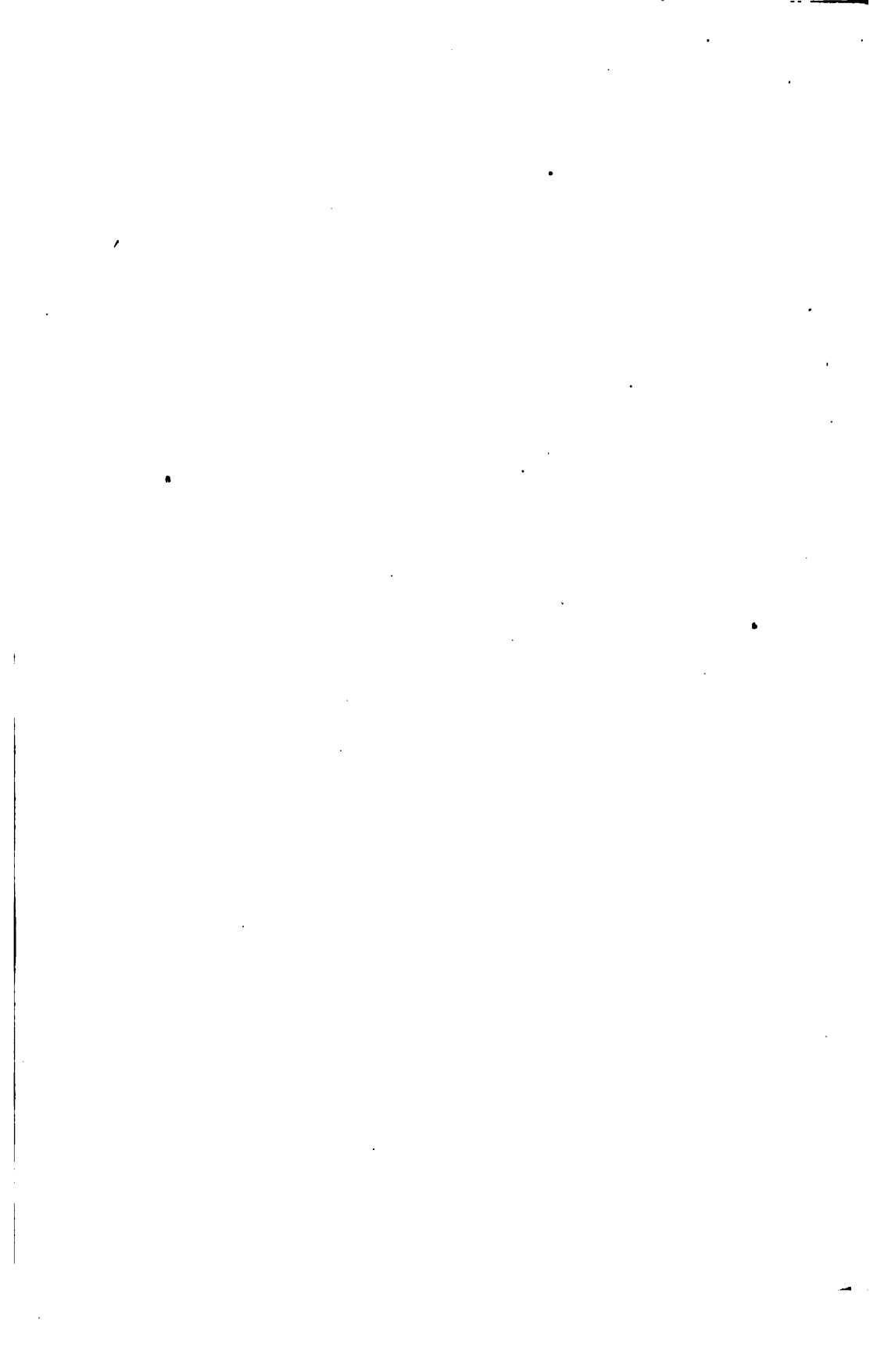
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PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE
MEDICAL AND SURGICAL SCIENCES

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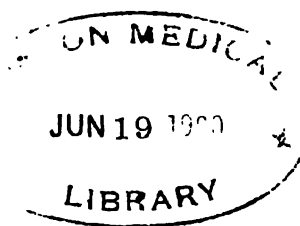
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VOLUME II. JUNE, 1920

HERNIA—SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA—GYNECOLOGY—
DISORDERS OF NUTRITION AND METABOLISM; DISEASES OF
THE GLANDS OF INTERNAL SECRETION; DISEASES OF
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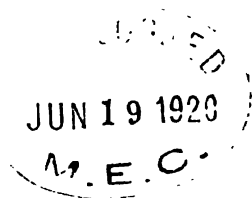


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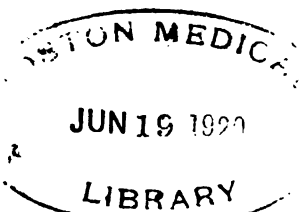
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PROGRESSIVE MEDICINE.

JUNE, 1920.

HERNIA.

By WILLIAM B. COLEY, M.D.

Diaphragmatic Hernia. Diaphragmatic hernia has been receiving more and more attention in recent years on the part of internists as well as of surgeons. The difficulties in the diagnosis, which, in the past, have been responsible for the failure to recognize this condition, are gradually being cleared up by wider experience.

Soresi¹ has made an admirable presentation of the subject. In the earlier cases the diagnosis was generally made on the autopsy table. In recent years the very large herniæ, in which the stomach, and often a large amount of small intestine, has escaped into the thoracic cavity, have been recognized, and many of them have been successfully operated upon. Soresi believes that, with the great improvement in x-ray technic, we should be able to make the diagnosis in the small diaphragmatic hernia also, most of which has been recognized only at the autopsy. Diaphragmatic hernia, even of moderate size, may produce very serious symptoms which, if neglected, lead to serious invalidism and shorten life. Soresi emphasizes the fact that even recent text-books, and text-books devoted exclusively to the surgery of the abdomen, often do not mention the subject of diaphragmatic hernia or devote but a few lines to it. Diaphragmatic hernia is a condition requiring immediate surgical intervention if the patient is to be cured and life preserved. It is extremely important that operation be performed in the early stages of development, for the reason that in the early stages the operation is far more simple and far less dangerous. If the hernia goes on unnoticed for a considerable period, larger and larger portions of the abdominal contents find their way into the thoracic cavity, adhesions are apt to occur, and operation becomes much more difficult and often impossible.

Soresi believes that the condition is not nearly so rare as has been thought. That so few cases have been recorded, he regards due to the fact that autopsies are made only on a very small percentage of cases, and in many cases in which patients actually died of diaphragmatic hernia, death has been attributed to some other pathological condition,

¹ Annals of Surgery, March, 1919, p. 254.

because the diagnosis of diaphragmatic hernia was not made in life, and no autopsy was performed. In answering the question why the diagnosis of diaphragmatic hernia is so seldom made, Soresi believes the two main reasons are (1) that the condition is supposed to be very rare; (2) that no symptomatology peculiar to diaphragmatic hernia, except in very large ones, has ever been made. He believes that internist and surgeon should think of the possibility of a small diaphragmatic hernia in cases suffering from obscure abdominal symptoms, just as they think of the possible presence of ulcers, adhesions and kinks. He believes that in every case in which laparotomy is performed, the diaphragm should be carefully explored, even though other pathological conditions are found which might explain the symptoms.

As regards *symptomatology*, it is not possible to formulate any definite rules, because at present no symptomatology is known for small diaphragmatic hernia. The number of cases so far is too small, and such data as have been gathered, have not yet been properly recorded and tabulated.

A few years ago, the same condition existed as regards gastric and duodenal ulcer. Large diaphragmatic hernias are easily diagnosed when their existence is suspected by the classical signs of tympanism in the thorax and with the aid of the x-rays. In the small ones the diagnosis cannot be easily made, even with the help of the x-rays; in fact, by their supposed and apparent negative findings they often hinder the physician in arriving at the correct diagnosis. Soresi states that a small opening in the diaphragm, through which a very small portion of the stomach might pass, cannot be diagnosed always with the x-rays, because when the barium meal fills the stomach, no barium might have entered the herniated portion, or the portion itself at that moment was not herniated, and even the air bulb might not show any appreciable change, or, as it has happened, the barium-filled portion is mistaken for a diverticulum of the esophagus.

Soresi states that the subject of diaphragmatic hernia is worthy of any attention the medical profession might pay to it, is proved by the cases reported by him, which, although few in number, show clearly that the diagnosis of diaphragmatic hernia would have prevented a useless operation in 2 cases and in all 3 it was essential in saving the patient's life. In 1 of his 3 most interesting cases, the subject was a girl of nineteen, in which the symptoms of dysmenorrhea, constipation, indigestion and severe pain in the abdomen, caused her to be operated upon by one surgeon, and a right ovarian cyst was all that was found. This was removed, but her symptoms continued. Later she was operated upon by Soresi. In this case test-meals failed to reveal any pathological condition of the digestive tract, but a certain delay in the emptying of the stomach, and the provisional diagnosis of adhesions was made.

Upon opening the abdomen the second time, some slight adhesions between the stomach and abdominal wall were found, but nothing that could be regarded as sufficient to account for her trouble. Careful examination of the diaphragm showed a gap about 3 cm. in length around the esophagus on the left side. The stomach was adherent to

the edge opposite the esophagus and the whole diaphragm appeared rather thinned. The gap was closed; the patient made a good recovery and her symptoms disappeared.

The second case was discovered only accidentally by Soresi, and he states that all three cases would probably have ended in death that would never have been attributed to the existing diaphragmatic hernia.

When there is suspicion of the existence of a small diaphragmatic hernia that is not revealed by the *x-ray* examination, Soresi advises the following procedure: The patient is given a mucilage of barium sulphate, made up with syrup of acacia or tragacanth, so as to have a good and uniform suspension of the barium. The patient is examined in the standing position looking at the physician while he drinks the barium mucilage, and the abdomen is massaged. If the hernia does not show itself, the patient is examined in a prone position. If the examination is still negative, the patient is examined by changing the positions, as done when he was standing; if the examination is still negative, the patient is put in a slight Trendelenburg position and instructed to breathe deeply, relaxing the abdominal muscles, and, by stopping the respiration, also relaxing the diaphragm; if the examination is still negative, a massage of the abdomen over the stomach and continued examinations might reveal the presence of the hernia, which had not been seen previously.

As regards *treatment*, Soresi states it is obvious that only surgical intervention can be considered; the possible existence of a small or large diaphragmatic hernia is of great interest for both the physician and the surgeon, but once the diagnosis is made or suspected, the patient belongs to the domain of surgery. The classical manner of dealing with diaphragmatic hernia is to operate from the chest; he believes that the chest route should be used only in exceptional cases; the safer and more rational route being the abdominal. In fact, he believes that most diaphragmatic hernias will be diagnosed only while operating on abdominal organs, and even if the abdomen has not been opened, the patient being operated upon through the chest route, the abdomen should be explored in all cases of diaphragmatic hernia, for the possible, and probable, coexistence of other pathological conditions, either secondary to the hernia or independent from it. He believes that it would be a useless and dangerous procedure to open the chest, when the hernia can be completely reduced and its reproduction prevented by operating through the abdomen. The chest route should be reserved for those cases in which the herniated organs have contracted strong adhesions on account of which their liberation is not possible through the abdomen, that is to say, when they have formed such strong adhesions that they cannot be freed without causing serious damage, either to these same organs or to the organs with which they have formed adhesions. I strongly concur in believing the abdominal route the preferable one.

SUTURING THE DIAPHRAGM. Soresi states that the suture he recommends has been found to be most satisfactory both in clinical and experimental work; it aims to approximate the edges very closely, in fact, it overlaps them, and to keep them closely approximated. The

stitches are put in such a manner that they cannot tear the tissues, but can stand any amount of strain from the very moment they are put in. The suture closes up the corners of the gap securely and completely;

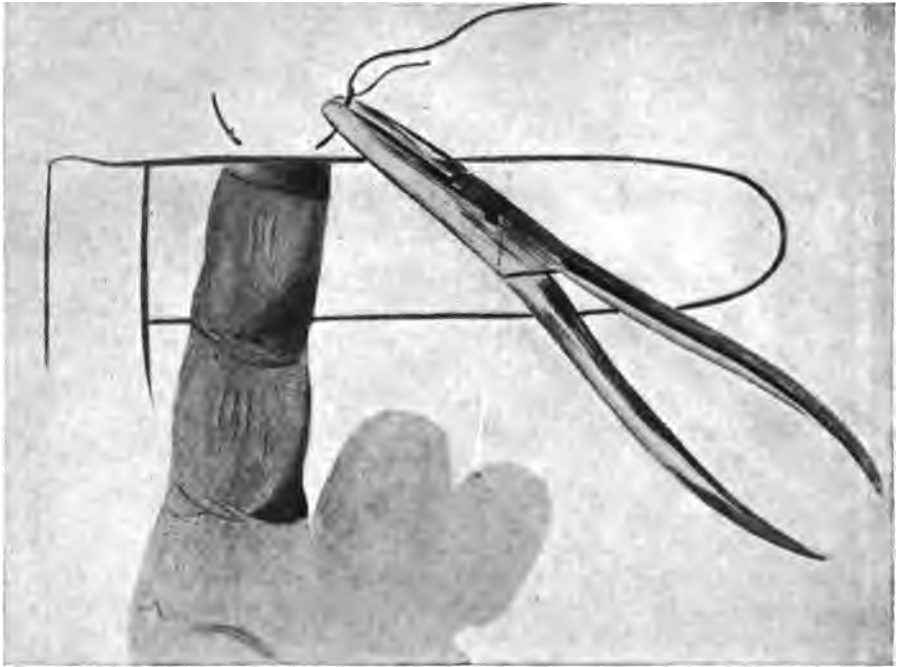


FIG. 1.—Manner of putting sutures that will close the gap in the diaphragm: the index finger preventing any organ to be included in the suture.

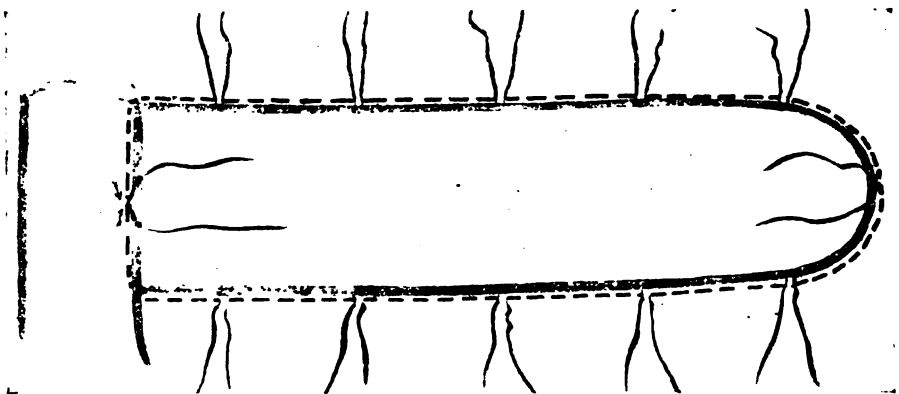


FIG. 2.—Stitches placed all around opening in the diaphragm.

in fact, it fulfils all the conditions he believes to be essential for a good suture of the diaphragm. The illustrations give a very good idea of its application. It will be seen that the suture devised by Soresi securely

closes the gap in the diaphragm and no strain is put on any single stitch, the suture being made by single threads which form a continuous line on each side of the gap and pull together without the possibility of cutting the parts that have been sutured, the tension being on the whole line.

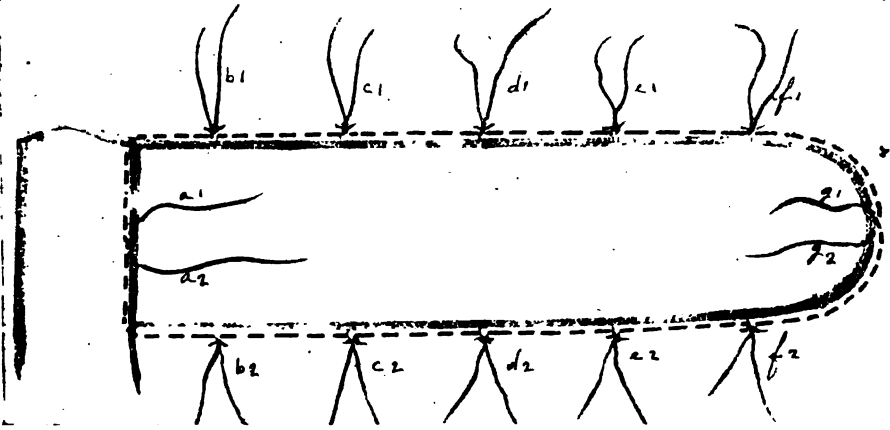


FIG. 3.—Stitches being tied to each other, each thread tied with its neighbor.

He states that the reason he recommends black silk is that it is easier to properly place the stitches if the silk is black and therefore more easily distinguished from the surrounding tissues, than if material of neutral

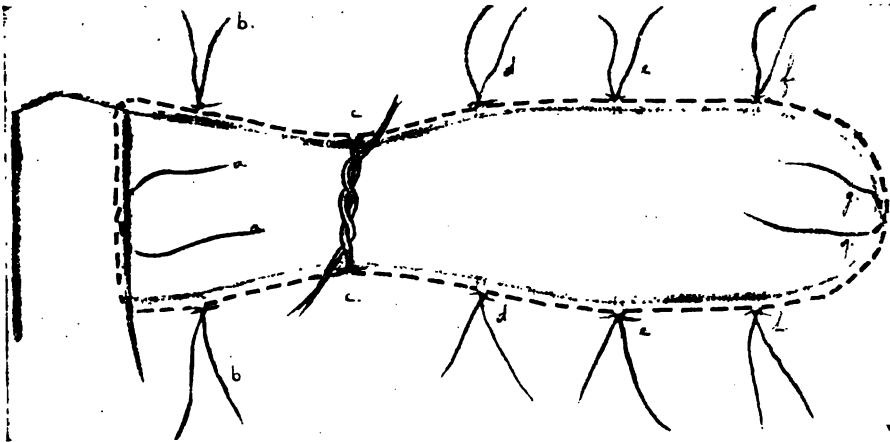


FIG. 4.—Closing gap in the diaphragm by tying together stitches opposite to each other, a with a, b with b, c with c, etc.

color were used. He prefers silk to catgut, "because silk will not be absorbed, is encysted in the scar tissue and therefore renders the scar stronger." Personally, I believe chromic catgut or chromic kangaroo tendon much better than silk.

Diaphragmatic hernia has assumed new prominence and importance since the great war. Wounds of the diaphragm sufficiently large to permit the escape of abdominal contents into the chest cavity are a comparatively rare occurrence in civil life, but a great many such

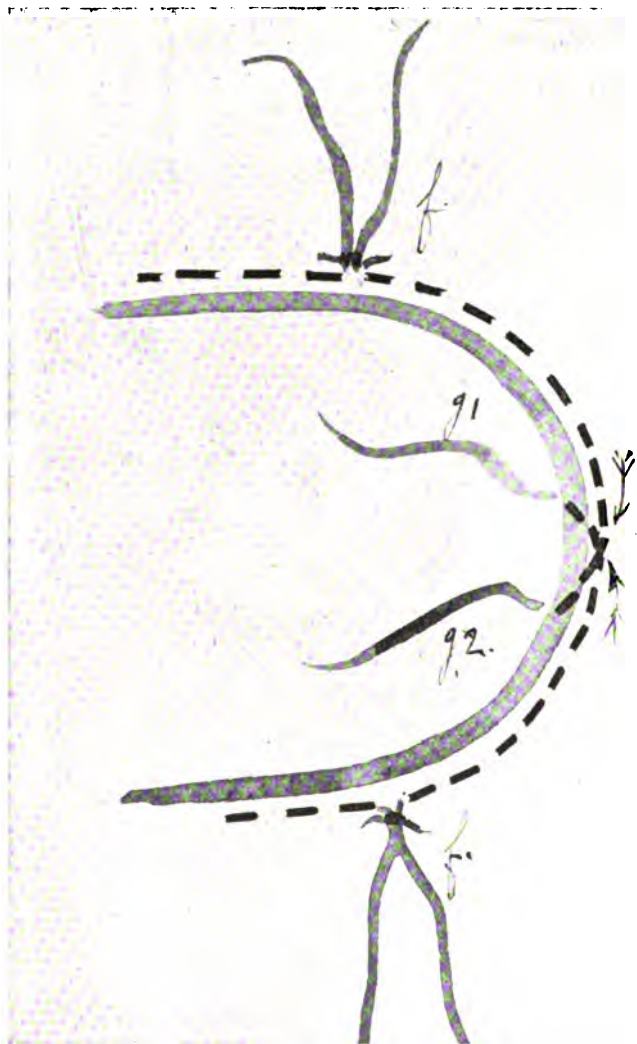


FIG. 5.—Details of how to close corners—note how threads *q1* and *q2* overlap each other, so that when they are tied they approximate securely the parts that have been sutured.

wounds have been observed during the war. One of the main reasons why diaphragmatic hernia occurs so often following a wound of the diaphragm is the fact, brought out by Cruveilhier many years ago, that wounds of the diaphragm practically never heal spontaneously. Cruveilhier's observation was recently confirmed by Lapelle.

Chastenet de G ry² has collected 10 cases from the French literature since 1914, in only 4 of which was the diagnosis made clinically. De G ry recognizes three classes of symptoms: (1) The purely abdominal; (2) those which are chiefly confined to the chest; (3) those which present a combination of abdominal and thoracic symptoms. While obstruction is occasionally found, one is more apt to see an incomplete obstruction without much distention; oftentimes the abdomen is almost flat and apparently normal, but vomiting is severe and often consists of coffee-ground material. Some of the important chest signs to be

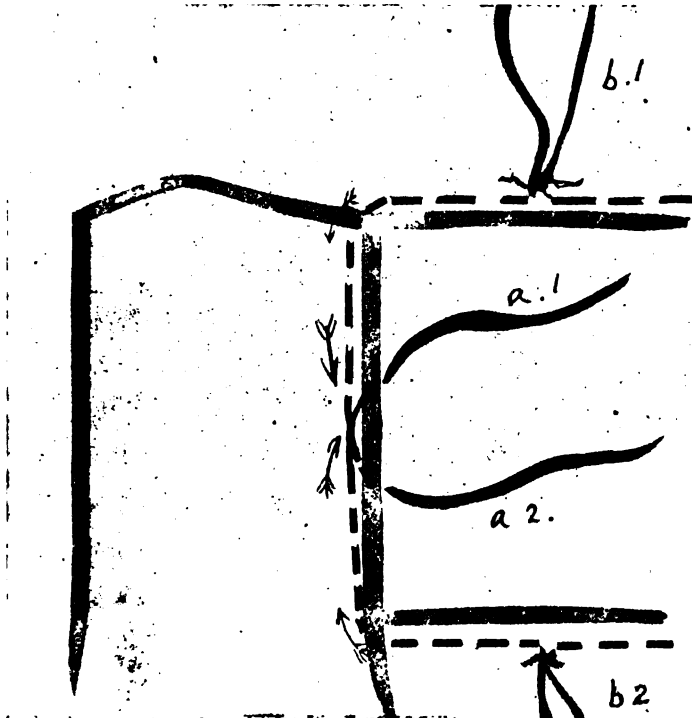


FIG. 6.—Details of how to close diaphragm around esophagus, threads *a1* and *a2* enter the superficial layers of the esophagus and are pulled and tied together after stitches *b1* and *b2* have been tied, so as to occlude completely the gap around the esophagus; for clearness illustration shows threads entering the lumen, in actual operation this will not happen, if only superficial layers are interested with the suture.

noted are dulness at the base of the left chest and absence of breath sounds. The reason why diaphragmatic hernia occurs practically always on the left side is, of course, due to the anatomical fact that the right side is carefully protected by the liver. Intercostal and epigastric pain may be present and at times extremely severe. The chest signs may be so prominent that the abdominal ones are overlooked and operation is postponed until too late. The condition is sometimes mistaken for pyopneumothorax.

² *Gaz. des H p.*, September 13, 1919.

One of dé Gery's cases was so far advanced at the time of operation, that fecal fluid was found in the chest cavity and an intestinal fistula had developed, yet the patient finally recovered.

While some surgeons advocate operating through the chest, others advise the abdominal route. The best opinion, I believe, leans toward a combination of the thoracic and abdominal. The method of Auvrey has many advantages. The ninth rib is resected and the incision prolonged to the umbilicus; the cartilage of the ninth rib is cut through and the diaphragm incised up to the hernial opening. The diaphragm is then carefully sutured and the wound closed. In some cases difficulty is found in suturing the opening in the diaphragm on account of its large size. De G  ry believes that a fascial transplant could be used to advantage in such cases.

Darvall Barton³ reports a case of diaphragmatic hernia successfully operated upon at the Monte Video, Weymouth.

These cases are so rare that each additional case is worthy of report, and Barton's case is of special interest, as the hernia was undoubtedly caused by a wound inflicted by a bullet from an automatic pistol on April 15, 1917. The bullet had entered over the eighth left rib close to its junction with the cartilage, and made its exit in the left loin two inches from the spine. He remained in bed for three weeks and was sent back to France in September, 1917. After the first long march he had an attack of vomiting which recurred every day for nine months, usually in the evening. Although he reported sick several times, he always returned to duty, and was looked upon more or less as a malingerer. Early in December, 1918, he again had an attack of complete constipation; he passed no feces after several enemas, and vomited "coffee-ground" material. On December 14, after a provisional diagnosis of diaphragmatic hernia had been made, the abdomen was opened just below the costal cartilages. A hole was found in the diaphragm, which readily admitted two fingers; the stomach could not be found at all, and very little omentum. The abdominal wound was closed and then an opening in the thorax made by resecting portions of the seventh and eighth ribs, including their cartilages. The lung was collapsed and the greater part of the omentum, plus stomach, were found in the pleural cavity. There were no adhesions. The abdomen was again opened and reduction of the stomach and omentum was easily accomplished by traction from below the diaphragm as well as by pressure from above. The hole in the diaphragm was repaired by suturing the edges of the rent with catgut. He made an excellent recovery, although the collapsed lung did not fully expand.

The ease with which the diagnosis is often overlooked in a far advanced case of diaphragmatic hernia, and the great hardship resulting from delayed diagnosis, is well illustrated by a case of Andrew in the *British Medical Journal*, September 27, 1919, p. 412.

The patient, a rifleman, aged twenty-two years, was shot on March 12, 1917, the bullet entering the left side of the chest behind and imme-

³ *British Medical Journal*, June 31, 1919, p. 767.

diately below the twelfth rib, two and one-half inches from the median line. It was extracted from the skin on the following day. Milk was given by the mouth, at the casualty clearing station, and was retained. He was removed to a base hospital and arrived in England on April 17, 1917. Several months later he passed through a general hospital and then a convalescent home. Although, during all of this time, he suffered much pain after taking food, and frequently stated that he felt ill, he was sent back to France for duty on July 27, four months after receiving the wound. Every day while on duty he suffered severe pain and was totally unable to digest the ordinary ration. He was still regarded by the medical officers of the army as a malingerer, and kept on duty. He finally became so weak that on December 28, 1917, he was returned home as a case of gastritis, and was treated for gastritis for eight weeks. He then spent thirteen weeks in a convalescent home without improvement. A visiting medical officer marked him "fit for discharge from the service" and for this purpose he was sent back to the hospital to which he had been sent on his return from France. Instead of giving him his discharge, he was granted ten days' leave and marked "for duty." He became ill and was sent to one of the medical wards, where he was treated for gastritis. Finally, on July 25, 1918, fifteen months after being wounded, he was discharged from the service as a case of gastritis.

On February 19, 1919, still being very ill, he came under the care of Dr. Andrew, a visiting surgeon to the Victoria Infirmary of Glasgow. His constant pain immediately after eating, accompanied by a feeling of great distention, suggested the possible diagnosis of perforation of the stomach with hour-glass contraction. An x-ray photograph was immediately taken which showed the entire stomach situated above the diaphragm, and in the left pleural cavity. An operation was performed at once and the patient made a slow but uncomplicated recovery.

Andrew, who is himself a Lieutenant-Colonel in the British Army Medical Corps, states that since 1914 several cases of similar nature have been recorded but none in which the x-ray picture clearly showed the herniated stomach. A case very similar to Andrew's was that of Captain Arthur J. Evans, in which almost a year had elapsed before the operation was performed, and, according to Captain Evans, "The most interesting point about the case is how the patient ever managed to survive the most extraordinary trials he must have gone through before it was recognized that he was a serious case."

In both of these cases the entire stomach and omentum had passed into the left pleural cavity and in both the difficulty lay in returning the omentum.

Before the Western Surgical Association, in December, 1919, Riggs,⁴ of South Dakota, reported a very interesting case of diaphragmatic hernia successfully treated by operation.

In this case the patient's hernia, which Riggs states was of true traumatic origin, in my opinion, would be more accurately described

⁴ *Annals of Surgery*, March, 1920, p. 276.

as due to frequently repeated increase in intra-abdominal pressure incident to her vocation. She was a washerwoman, aged thirty-four



FIG. 7.—Phrenic hernia caused by fracture of the ribs. (From Cooper, "Hernia," 1804-1844.)



FIG. 8.—Phrenic hernia in the fetus. *g. g.*, bougie passed through diaphragmatic aperture. (From Cooper, "Hernia," 1804-1844.)



FIG. 9. — Strangulated phrenic hernia in adult. *i*, a bougie under strangulated colon and omentum. (From Cooper, "Hernia," 1804-1844.)

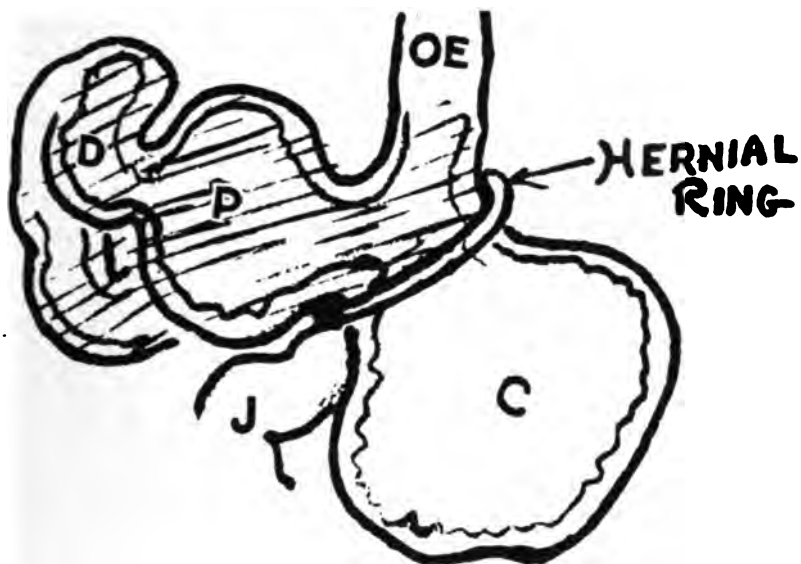


FIG. 10.—Diagrammatic drawing after abdominal exploration. Showing hernial ring with pylorus and duodenum within sac.

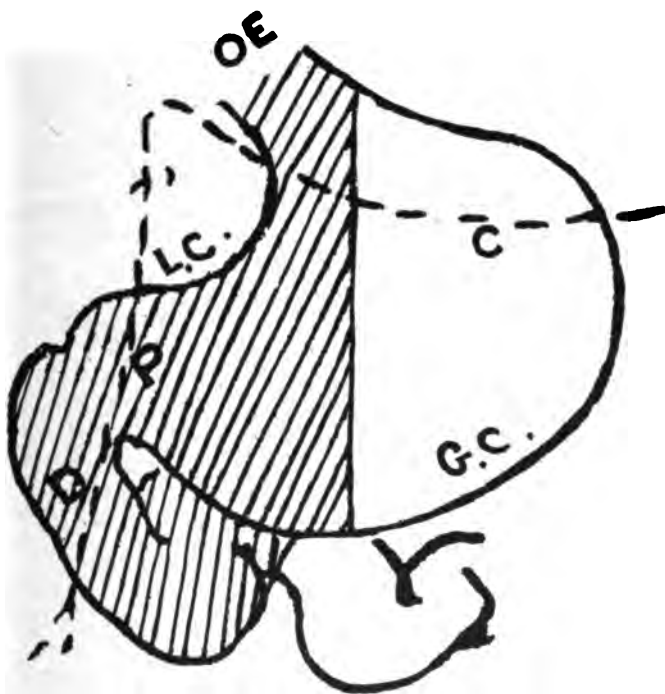


FIG. 11.—Diagrammatic drawing after reduction. Shaded portion formed hernial content.

years, who had been in the habit of carrying a heavy wash-tub full of water some fifty feet, with the side pressing against her abdomen. Some

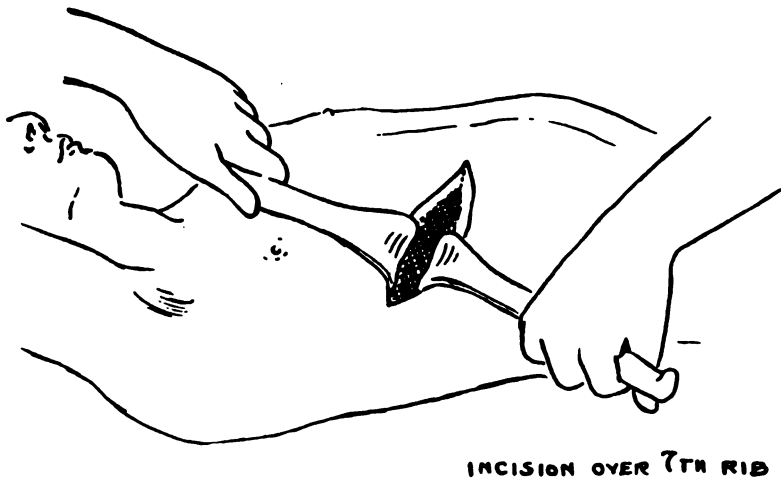


FIG. 12

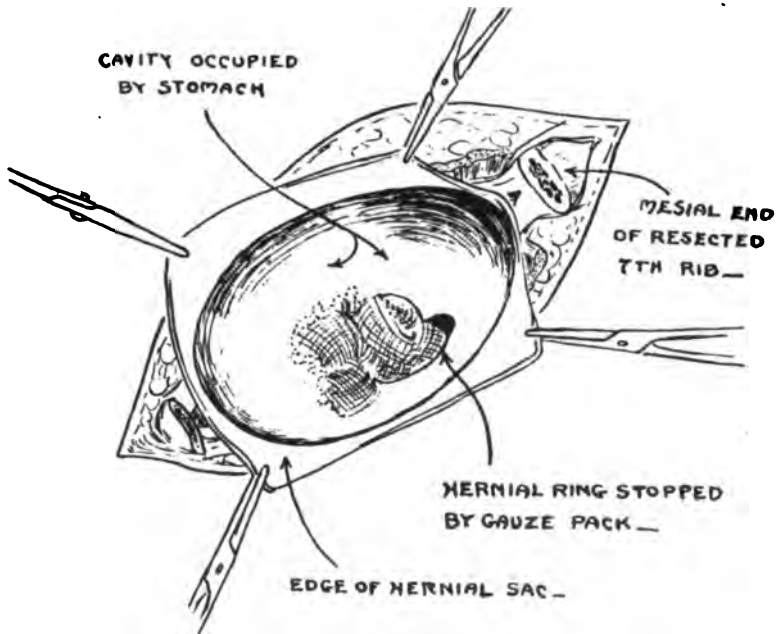
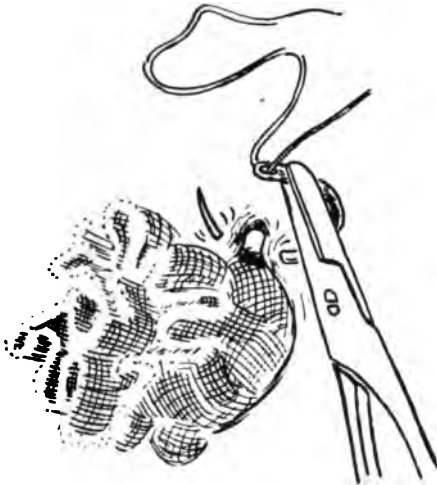


FIG. 13

two and one-half years previously, sharp, sickening pain developed in the upper abdomen, which ceased when she relieved herself of the weight of the pail. Recurring attacks of mild nausea and eructation gradually

increasing in frequency, were noticed during the ensuing year and a half. Six months before the operation the nausea ceased, but the vomiting occurred within ten to sixty minutes after nearly every meal; no appreciable loss of weight. Two *x*-ray pictures were taken, neither of which proved satisfactory.



**STARTING SUTURE OF
HERNIAL RING -
STOMACH RETAINED
IN ABDOMEN BY PACK.**

FIG. 14

At operation in December, 1918, a right rectus incision was made. The transverse colon of the stomach was found to pass upward through an opening in the diaphragm, slightly to the right of the median line. The contents of the hernia consisted of the pyloric portion of the stomach

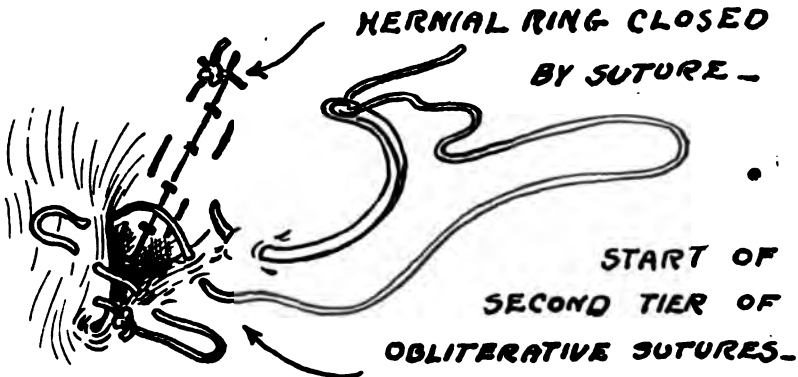


FIG. 15

FIGS. 12 to 15.—Various steps in the operation for closure of the hernia.

- the greater portion of the transverse colon and almost the entire omentum. For closure, four double sutures of No. 3 plain catgut were passed through the two margins of the opening. The patient made a good recovery, with complete relief from the symptoms.

CONGENITAL DIAPHRAGMATIC HERNIA is much more rare than the traumatic variety. Frank,⁵ of Louisville, Ky., has recently published a very interesting case. When Scudder made his collection of diaphragmatic hernia in 1912, he could find only 53 cases that had been treated by operation. Since that time Frank has been able to find reported in the literature only 41 additional cases, 5 of which were of the congenital type. In the 53 cases described by Scudder, there were 39 deaths.

Frank disagrees with Beckman, who held that the congenital type was not likely to be benefited by operation.

In his article, Frank reports a personal case: A male, sixteen years of age, who was admitted to the hospital on February 2, 1919, with a history of having had frequent attacks of nausea and vomiting ever since childhood, the latter occurring mostly during the night. Sometimes he has as many as six attacks a day. For weeks at a time he would vomit food two or three times a week; attacks were accompanied by pain, "bloating of stomach" and vomiting. Eating usually caused discomfort. Another symptom worthy of note is, that, shortly after his stomach had apparently completely emptied itself, it would suddenly regurgitate an additional quantity of food. A careful study of a series of stereoscopic plates showed the presence of a large diaphragmatic hernia, nearly filling the right chest cavity, the sac containing half of the stomach and a large quantity of the duodenum. Exploratory operation by median incision revealed the stomach with the duodenum, a large part of the omentum, and a small portion of the liver, herniated into the right chest cavity through an opening which would easily admit four fingers. The contents of the sac were reduced with difficulty. The sac was not cut away but closed with deep through-and-through sutures extending from near the esophagus directly across the neck of the sac. (Method of placing the sutures is shown by accompanying diagram.) The patient made a good recovery.

Inguinal Hernia. Pitzman,⁶ of St. Louis, who served in the Medical Corps, U. S. A., in an article "Suggested Step in the Technic of Inguinal Herniotomy," discusses the VARIOUS MODIFICATIONS OF INGUINAL HERNIOTOMY at present in vogue, and strongly dissents from the view which, I believe, is generally held at the present time, that the sac not only plays a very important role in the etiology of hernia, but also that its complete removal is an important step in the radical cure of hernia. He believes the pendulum has begun to swing the other way, and the idea that the sac is more or less responsible for the development of the hernia is really another case of confusion of cause and effect.

He states that the gist of the newer argument is that hernia is caused by greater intra-abdominal pressure than the particular wall can withstand; that under such circumstances a hernia forces its way out through the musculo-aponeuroticofascial layers of the abdominal wall; and the hernia causes the sac in absolute contradistinction to the older opinion that the sac causes the hernia. It is this theory which forms the

⁵ *Annals of Surgery*, March, 1920, p. 280.

⁶ *Surgery, Gynecology and Obstetrics*, March, 1919, p. 329.

foundation on which his suggested step in technic rests; while the practically universal custom of resecting the sac and closing off the peritoneal cavity before proceeding to the repair of the musculo-aponeuroticofascial layers of the abdominal wall rests on the older conception of the sac causing the hernia.

He states that his suggestion in technic is simply "to insert the mattress sutures for the repair of the abdominal wall, while the peritoneal cavity is still open. With the finger introduced through the abdominal ring, the strength and character of the tissues forming this ring can be accurately determined and the sutures carried through all the layers of the abdominal wall at appropriate points. Careful surgeons are justly afraid of sinking their needle deeply into these layers from the outside inwardly, but, with a finger inside the abdominal cavity, no excuse seems pardonable for failure to get a good firm grip on all the tissues forming this ring, that is, the internal oblique muscle and aponeurosis, the transversus muscle and aponeurosis and the transversus fascia. On account of fear in regard to this comparatively blind step, many otherwise competent surgeons skimp the stitch until, as a matter of practice, they have grasped little more than the superficial muscular fibers of the internal oblique muscle. And, in view of the danger of intestinal adhesions, or bladder attachment in the neighborhood of the abdominal ring, only a very brave, or perhaps foolhardy, man would attempt as deep a grasp on the tissue as he could safely accomplish from within outwardly." As regards the sac, he states that he always resects at least the inguinal portion of a thickened sac, while the thin ones can be either resected or inverted. But, as he lays so much stress on the repair of the abdominal wall, and so little on the sac, he seriously doubts that it is necessary to pay any further attention to it, once the abdominal cavity has been opened.

Personally, I do not find that Pitzman has offered any fact that either proves or disproves the importance of the sac as an etiological factor in inguinal hernia. No one who has had a large experience in operating upon hernia in children can possibly doubt that the presence of a preformed or congenital sac is not only an important, but a predominating, etiological factor. In the presence of a large open funicular process in a young child, it will be almost invariably seen that the daily periods of greatly increased abdominal pressure, due to crying, straining at stool or coughing, will be sufficient to cause the ever-present omentum to find its way into the upper portion of this open funicular process and, acting like a wedge, gradually dilate the opening, thus converting the potential hernia into an actual one, no matter how well-developed the internal oblique muscle and other tissues may be that form a normal inguinal canal. The same is true to a lesser degree later in life. If the open funicular process be very small and the muscular structures of the canal be unusually strong, a person may go through life without ever developing a hernia. That this is true has been often shown by autopsy studies, particularly those made by Murray in Liverpool. This does not mean that no hernia ever develops without the presence of a preformed sac. We know that direct hernia usually develops with-

out a congenital sac and is due, as Pitzman states, to greatly increased abdominal pressure, forcing its way through the weakened muscular layers of the abdominal wall.

I can see no advantage whatever in Pitzman's suggestion of inserting the mattress sutures while the peritoneal cavity is still open, with the fingers through the abdominal ring, and the reasons he gives for this step appear to me to have little weight. It is entirely unnecessary that the needle should go through all the layers including the peritoneum. In fact, the internal oblique muscle is brought over into better apposition with Poupart's ligament if it is allowed to slide over the peritoneum, than if it is included in the peritoneal layer. The real proof that the step is unnecessary is found in the ideal results that have been obtained without this step. In most cases the finger under the internal oblique muscle enables one to put the sutures down to the transversalis fascia, without any danger of injuring the deeper structures. In children, where the parts are on a smaller scale, the same thing may be accomplished by placing a pair of dissecting forceps underneath the muscle and having the needle go through the internal oblique from above downward, coming out through the opening between the blades of the forceps. The needle is visible all the time, and there is not the slightest risk of injuring the other structures.

As regards Pitzman's suggestion, to use a curved, round needle instead of a needle with a cutting edge "to minimize the danger of injury to the deep epigastric artery" (or hypogastric artery, as he thinks it should be called), this, too, I think is unnecessary in the hands of any one who has had any considerable experience with the operation. In a series of over 7000 operations performed at the Hospital for Ruptured and Crippled, we have not had a single case of injury to the vessels by means of the curved Hagedorn needle with its cutting edge, the one that has been used in every instance.

Pitzman states that "for the usual indirect inguinal hernia he has long felt that the technic which most nearly reproduced the normal anatomical relations of the spermatic cord, is much to be preferred to the other proposed technics. On theoretical grounds, he objects to any technic which brings the spermatic cord straight out through the abdominal wall, and prefers the technic which brings the cord out on its normal valve slant. In other words, he makes use of that Bassini technic which brings the musculo-aponeuroticofascial layers down to the inguinal ligament of Poupart, deep to the spermatic cord. Finally, he sews the cut edges of the external oblique together superficially to the cord. He insists that this is the normal relation of the parts, and is a herniotomy without transplantation of the cord.

It is not entirely clear from his description whether the internal oblique is sutured to Poupart's ligament underneath the cord, as done according to the modified Bassini technic, or over the cord, as suggested by Ferguson and others. Presumably, he follows the Bassini technic and sutures the muscle beneath the cord, but does not approve of characterizing it as a transplantation of the cord.

Our statistics at the Hospital for Ruptured and Crippled show decid-

edly better results where we have adopted the Bassini technic of suturing Poupart's ligament underneath the cord, which we have, in common with most other writers, always designated as "transplantation of the cord," than in cases in which the cord has not been transplanted.

Pitzman's conclusions are:

"1. All types of hernia are caused by greater intra-abdominal pressure than the particular wall can withstand.

"2. The newer point of view, that the hernia causes the sac, in contradistinction to the sac causing the hernia, deserves serious consideration.

"3. Greater operative emphasis should be placed on the repair of the musculo-aponeuroticofascial layers of the abdominal wall.

"4. My suggestion in technic is that the sutures for the repair of the wall should be placed before the peritoneal cavity is closed."

Before the New York Surgical Society, March 12, 1919, Franz Torek,⁷ of New York, has described a method of operation for inguinal hernia, by which almost 100 per cent. cures have been obtained. He states that he described the method fourteen years ago and that it has been modified only in details of minor importance since that time.

In 1912, Torek published a report of 304 cases operated upon by this method, which had all been traced to end-results. He now adds a second series of cases, covering about six and a half years, up to the end of 1917, making a total of approximately 600 cases, in which only 2, or one-third of 1 per cent., have shown recurrence. The first of these recurrences took place in a patient who developed gangrene of the abdominal wall which later proved to be of syphilitic origin, and in the second case the operation was performed by one of Torek's house-surgeons who had had little experience in operating, and hence it is fair to assume that this recurrence may have been due to careless technic. Torek believes that both of these recurrences could have been avoided and that the results should have been 100 per cent. cures, instead of 99½ per cent.

The main points in the technic of Torek's operation are brought out by the accompanying figures.

Torek states: "Of these points, the one in which my operation differs radically from all others heretofore described is the first point, the separation of the vas deferens from the bloodvessels of the cord and keeping them separated. The studies which led to the adoption of this procedure have been extensively explained in my previous communication and are here summarized in what follows:

"Within the abdomen the vas deferens and the bloodvessels of the cord are apart and separate from each other. At the internal inguinal ring they meet at an angle, the vessels approaching the ring from above downward, the vas from below upward (Figs. 16, 17, 18 and 19). At the site where they meet, an open wedge, or infundibulum exists through which intra-abdominal structures can force their way out, the protrusion being facilitated by this funnel-shaped arrangement. As a matter of fact, when an oblique hernia is formed, it always wedges its way through between the vas and the vessels. The diagrammatic illustrations by

⁷ *Annals of Surgery*, July, 1919.

some authors depicting the point of exit for oblique hernia as being below the cord are incorrect."

In closing the lower portion of the deep layer, Torek does not approve of the various methods employed, of utilizing the rectus fascia or muscle by incision of the rectus fascia. He believes that if the rectus fascia is incised upward far enough to facilitate the mobilization of the rectus, the fixed point, to which the internal oblique and transversus muscles



FIG. 16.—Interior view of lower abdomen and pelvis, showing relation of spermatic vessels and vas deferens at internal ring. Lateral view. Observe that vas and vessels meet at an angle, like the two sides of a wedge, thus facilitating the protrusion of a process of peritoneum (compare Fig. 18) and the development of a hernia. The illustration shows the relation in the normal state; in case of oblique inguinal hernia the internal inguinal ring is enlarged, the vas deferens and the bloodvessels being separated by the interposition of the sac (see Fig. 19). (After Spalteholz.)

are attached, also becomes more movable, and, in consequence, those two muscles become slack, thus weakening the upper portion of the plastic of which those muscles play so important a part. He therefore, draws over the muscle, with its fascia intact, to join it to Poupart's ligament. His sutures are placed from three-eighths to one-half inch apart, according to the amount of tension; the greater the tension, the closer the sutures should be. The lowest suture should be quite close

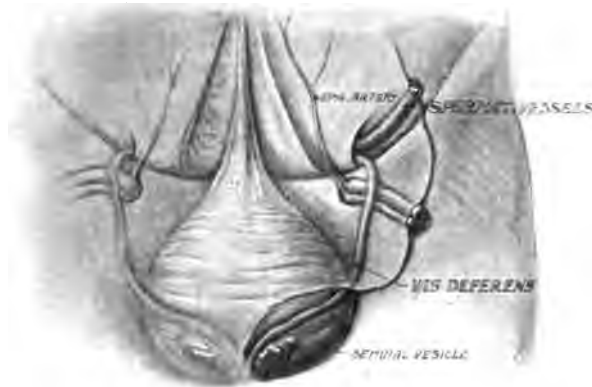


FIG. 17.—Same relations as in Fig. 16, seen from behind.

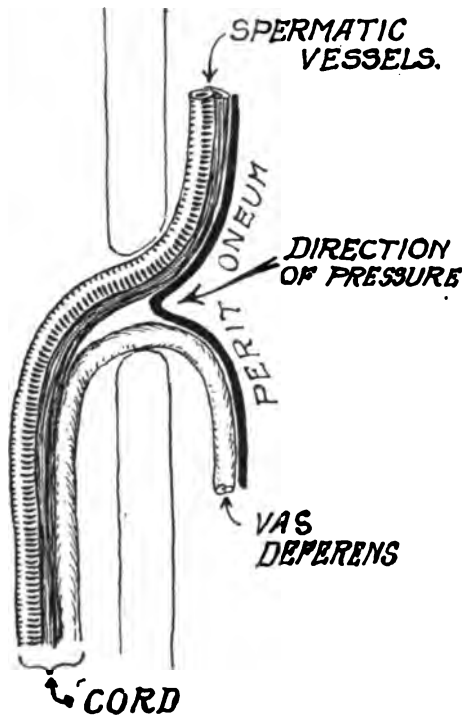


FIG. 18.—Diagram of relations of spermatic vessels and vas deferens at internal inguinal ring. Almost normal, but representing a beginning impingement of the peritoneum into the open angle of the wedge outlined by vessels and vas. Compare remarks under Fig. 16.

to the pubis. As regards suture material, Torek employs silver, usually No. 26, or slightly heavier for the lowest one or two sutures; for the remaining sutures, chromicized catgut, usually No. 3. In his former operation, he advocated the use of silver wire for all sutures, but has not given this up except for one or two sutures.

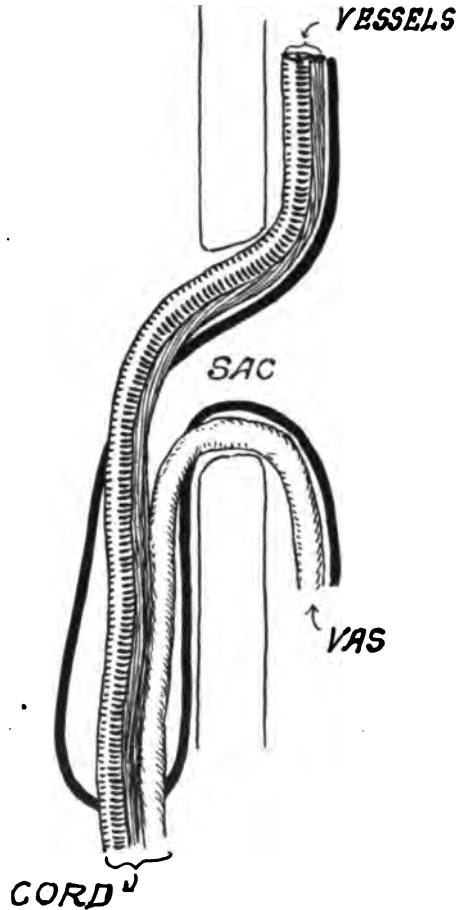


FIG. 19.—Diagram showing the relation of the sac to vas and vessels, the former being below, the latter above the sac. This relative position obtains only at the internal ring; farther down the relation becomes changed.

As regards the disadvantages of non-absorbable sutures which have so frequently been pointed out: Torek states that there still exists a sentimental objection against the introduction of non-absorbable material for buried sutures, although there is no doubt in his opinion that this material, whether it is silk, or linen thread or silver wire, has a definite place in surgical technic. However the introduction of these little particles of silver wire must not be likened to the use of a silver filigree to which there is a very valid objection. He states that when

the use of silver filigree was more fashionable than it is now, he had to remove a number of those appliances because they were broken and the sharp ends caused one or other kind of damage. Not so with the small piece of silver wire used in the individual suture, if its point is properly buried. He states that he has recently operated upon a femoral hernia in a patient, whom he operated upon for inguinal hernia eight years before, using silver wire for all of the buried sutures. At the time of the second operation he found that all of the sutures had remained in place without causing any trouble for eight years.

In regard to the closure of the external oblique, Torek believes—and rightly, I think—that the main barrier against recurrence lies in the deep layer, the internal oblique sutured to Poupart's ligament; that the external oblique plays a much slighter part in preventing a recurrence. He does not consider it necessary to overlap the external oblique but simply unites its edges by a continuous plain catgut suture.

One must admit that the results that Torek has been able to obtain with the method which he describes, have been practically perfect. He has evidently made a very careful effort to trace his cases to final results. The more carefully one studies his technic the stronger becomes the impression that these results are due not so much to the particular modification of the Bassini technic, as to the extremely great care which Torek has given to all of the details of the operation.

My own experience in operating upon oblique inguinal hernia fails to show any such anatomical relation between the sac, the cord and the vas, as Torek describes. I have practically always found the sac, and the cord spread in a fan-like manner over the whole posterior wall of the oblique inguinal sac. I do not think it makes the slightest difference as regards the percentage of permanent cure, whether the vessels of the cord and the vas are separated into two distinct portions, as shown in the method of Torek, or whether the sac and cord are allowed to come out of a single exit. The real point of importance is, placing a certain number, one or more, sutures, above the cord, making a new internal ring of definitely limited size. The Bassini method has been employed by myself for the past thirty years. I have placed one or two sutures above the cord to prevent a further widening out and enlargement of the only weak place in the original Bassini technic.

I am glad to learn that Torek has given up the use of silver wire except in the lowermost suture. I believe that in the very near future he will abandon the use of non-absorbable sutures altogether. Our own experience, at the Hospital for Ruptured and Crippled, shows that it is possible to obtain practically ideal results with absorbable sutures. I believe that Torek's views that chromicized catgut or kangaroo tendon, if used for the two lowermost sutures, where there is always a certain amount of tension, will not remain in place until union has become complete, are based upon theory rather than practice. If a fairly good-sized suture is used, *e. g.*, about the size of No. 2 catgut, there need be no fear that they will not hold sufficiently long. Actual practice in a very large number of cases has proved beyond question that they do hold. While, undoubtedly, in a number of cases silver wire sutures remain in a hernia

wound without doing any harm (in Torek's case, for eight years), our experience at the Hospital for Ruptured and Crippled shows that in many other cases they produce serious harm long before eight years have elapsed. Hence, again we make an urgent plea in favor of abandoning the use of non-absorbable sutures in all methods of operation for inguinal hernia.

Trick,* of Buffalo, N. Y., in an article on

The Dynamics of Abdominal Herniæ, suggests a theory for the development of abdominal hernia, which he believes, differs from the theories generally accepted. He defines a hernia as the protrusion of an organ into or through its surrounding wall, and states, that, in order to understand his theory, this definition must be literally accepted. He lays a greater stress upon intra-abdominal pressure as an etiological factor in the production of a hernia, and less weight upon the presence of a pre-formed or congenital sac, than most writers of the present day.

He suggests a typical *modus operandi*, as follows:

"A loop of flaccid bowel is located opposite the internal ring or femoral ring or some other weak spot (usually the point where some bloodvessel pierces the transversalis fascia) when it is suddenly exposed to concentric compression by the violent contraction of all the abdominal muscles, including the diaphragm, levator ani, etc.

"This violent compression causes the intravisceral gas to force a diverticulum of the bowel through the weak spot. When the force is released the bowel may fall back, but the distention of the opening thus caused makes a repetition much easier and each repetition increases the size of the protrusion or hernia.

"Nature may attempt to repair the damage by placing a portion of the omentum over the opening, but if the above-mentioned series of events should be repeated many times the piece of omentum would be hammered into the opening and would become a wedge instead of a plug.

"If the diverticulum, just mentioned, should be grasped and held by the edges of the opening through which it has passed we would have a Littre's or Richter's hernia—a relatively rare type.

"As considered in this thesis the only rare thing about a Littre's or Richter's hernia, would be the strangulation. In other words, the strangulation represents an accident to a hernia that was 'nipped in the bud.'"

In conclusion, Trick presents these three points for consideration, viz.:

"1. The most potent force in the production of abdominal herniæ lies latent inside the bowel and is applied from within, outward, *i. e.*, increased intravisceral pressure due to concentric compression exerted by the muscles of the abdominal wall.

"2. Developmental defects do not cause herniæ, but they represent the sites of potential herniæ and are more probably the result of this force applied during intra-uterine life.

"3. Proper repair of the transversalis fascia determines the integrity of the abdominal wall at that point."

* New York State Medical Journal, May, 1919, p. 166.

In my opinion, Trick's is a most interesting, and most plausible explanation of the etiology of abdominal hernia. It is well to bear in mind, however, that it is a purely theoretical explanation and Trick has brought forth no anatomical or clinical facts in support of it.

In most cases of oblique inguinal hernia, the weight of evidence is very strong, that the presence of a congenital or preformed sac, or open vaginal process of peritoneum extending into the canal, is the chief predisposing cause of the hernia. It is quite true that this sac, for a long period, may be only a potential sac, and that other causes play a part in the formation of the actual hernia; among these are the enlarged external ring, imperfect development of the internal oblique muscle and an abnormally large slit in the transversalis fascia opposite the internal ring.

I believe that the early stages of the dilation of the canal and of the preformed sac are due rather to a portion of omentum which finds its way into almost the smallest of openings and, under increased intra-abdominal pressure, acts like a wedge and gradually dilates the opening until it is of sufficient size to permit the entrance of the bowel.

In regard to the treatment of a hernia, Trick states that this is a matter of applied mechanics. While some herniæ in children are apparently cured by a truss, he believes, in the vast majority of cases, the truss is to be mentioned only to be condemned. With this sentiment I am in thorough accord. At the Hospital for Ruptured and Crippled we rarely operate upon children under the age of three or four years, although if a hernia is not easily controlled by a truss, operation should be performed, no matter what is the age of the child.

Femoral Hernia. The radical cure of femoral hernia by the inguinal route is again strongly advocated by Percival P. Cole,⁹ F.R.C.S., England, of the Seamen's Hospital, Greenwich. Although we have discussed the advantages and disadvantages of this operation for femoral hernia almost every year, and have attempted to show that the simpler operation through the femoral route, if properly performed, gives almost ideal results, it is only fair to receive all new data with an open mind.

Cole, during the period of the war, has had under his observation at various hospitals, 509 cases of hernia including all types, the ages of the patients ranging from nine months to seventy-two years. Thirty-seven of these cases were of the femoral type, ten being strangulated.

Among the reasons given for discarding the older operation through the femoral route, Cole states, that in Keen's *Surgery* it is noted that "mere ligation is attended by 30 per cent. of recurrences." Inasmuch as I am the author of the article on "Hernia" in Keen's *Surgery*, here referred to, it is only fair to say that the statement quoted was used to show that something more was needed than simple ligation. I later showed that if we added a purse-string suture to simple ligation, more nearly ideal results could be obtained than with the more complicated technic that attends the inguinal method. Cole states that the only reference

⁹ British Medical Journal, June 21, 1919.

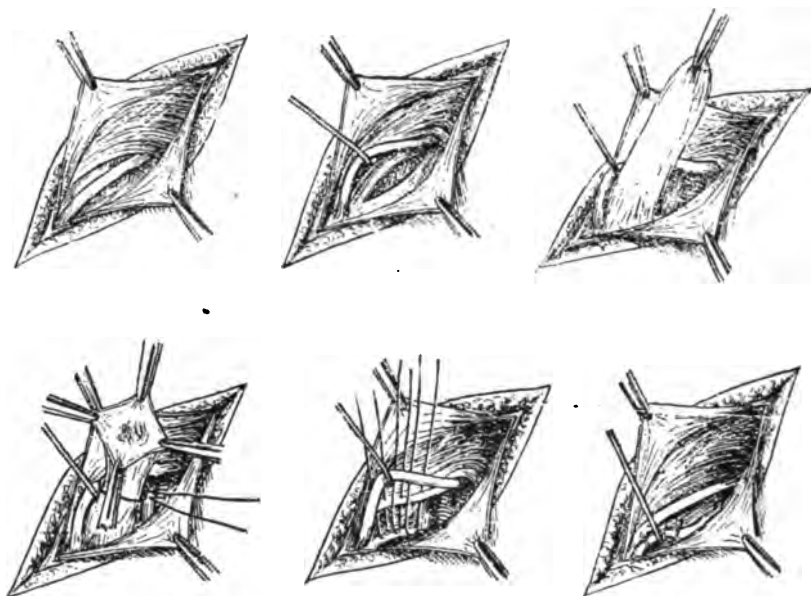


FIG. 20



FIG. 21

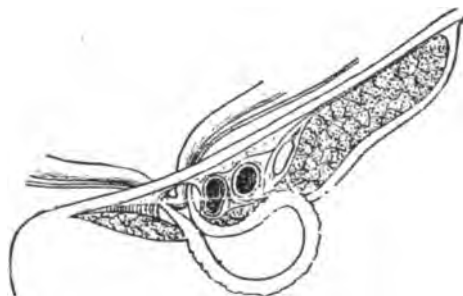


FIG. 22

to inguinal route in Keen's *Surgery* dubs it as complicated, and thereupon dismisses it. As I have frequently stated in previous articles in *PROGRESSIVE MEDICINE*, and I think the statement has never been challenged, the inguinal method is more complicated than the purse-string suture femoral method. The main point of my argument is that the results up to the present time show that high ligation of the sac plus purse-string suture of the femoral opening, gives practically ideal results, and until the advocates of the inguinal method are able to show end-results at least comparable, if not superior, to the ones that we have specifically shown can be obtained by the femoral route, I see no reason for giving up the simpler for the more complicated method of operation.

Again, Cole's article, like practically every article on the subject, fails to give the results.

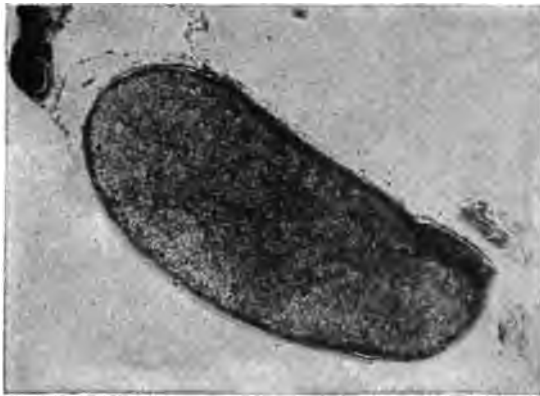


FIG. 23.—Photomicrograph ($\times 30$) of section of typical nodule embedded in hernial sac.

Adrenal Rests in the Walls of Hernial Sacs. Alexander MacLennan,¹⁰ of Glasgow, Scotland, has recently called attention to the adrenal rests in the walls of hernial sacs. He states that during the last four and a half years he has performed nearly 700 operations for the radical cure of hernia at the Royal Hospital for Sick Children in Glasgow. In six of these cases, or about 1 per cent., small nodules were found which, on microscopic examination proved to be adrenal rests. These nodules, he states, "are minute, not larger than one-eighth inch in diameter, and practically all of the same size. They are embedded in the wall of the sac near, but not attached to, the cord. They appear as brownish-yellow, flattened spherical particles. They require to be differentiated from fat lobules which they superficially resemble. So far only one nodule has been detected on each sac. Once the nodule was found loose inside the sac, but doubtless it had become displaced there, as the sac had been widely opened during its isolation. The sacs on which these rests have been found have been, with one exception, typically so-called acquired ones; the exception being a congenital hernia, *i. e.*, one where the tunica

¹⁰ *Surgery, Gynecology and Obstetrics*, October, 1919, p. 387.

vaginalis and the sac were common." He states that 40 of the 700 cases were females, and none of these presented the condition described, which is an interesting observation, inasmuch as accessory adrenal tumors are



FIG. 24.—Photomicrograph ($\times 80$) of section of typical nodule.



FIG. 25.—Photomicrograph ($\times 200$) of section of typical adrenal nodule embedded in a hernial sac.

commoner in the female. MacLennan has further not seen an example of adrenal rest in an adult hernia, but his operations have been mostly in children.

MacLennan states that the interest in his observation, besides the embryological one, lies in the support which it gives to the sacular theory of hernia. He refers to an article published in *Surgery, Gynecology and Obstetrics*, January, 1910, on the sacular theory, in which he showed the rare type of encysted hernia to be congenital, and believes that if the sacular theory requires still further support it receives it from this fresh observation. He adds that adrenal rests are recognized as being sometimes found lying along the cord or in association with the testicle, but their presence attached to a hernial sac claimed to be acquired, negatives such a supposition.

As regards the fate of these nodules, he believes they probably atrophy. They do not appear to give rise to tumors later on. He states that the removal of this supplementary adrenal tissue has not been detrimental to the children.

It is very curious that no cases of this kind have been noted at the Hospital for Ruptured and Crippled. During the last thirty years more than 7000 operations have been performed, and while we have had seven cases of tuberculosis of the hernial sac, no case that has been recognized as an adrenal rest has been observed. It is very probable that such have occurred but have been overlooked. We shall in the future make a most careful search for this condition.

Fatty Herniæ. Fatty hernia or fat hernia is a condition comparatively rare; strangulated fatty herniæ are still rarer.

Kelley Hale¹¹ reports a case of strangulated fatty hernia enveloping an empty femoral sac.

The most recent study of fatty herniæ is that of Joseph Ransohoff (1913). Hale gives a brief abstract of Ransohoff's 7 cases together with 16 cases previously recorded in the literature, and adds 1 of his own, making a total of 24 cases, 5 of which were strangulated.

Hale's first case is of sufficient interest to deserve mention in some detail.

The patient, female, while lifting a tub of dirt on November 16, 1917, felt a sudden pain in the region of the right groin. The pain continued and grew worse on the following day; she was confined to bed, complaining of extreme pain in the right groin; this was accompanied by persistent vomiting. No record of pulse or temperature was made. Examination showed a hard, tender tumor, the size of a small hen's egg, in the region of a femoral hernia. The patient was seen by the doctor's assistant, who stated there was no impulse on coughing. No taxis was employed; but hot and cold applications were used, and the patient's hips elevated. Hale was called to operate at 8 P.M. November 17, twenty-four to thirty hours after the beginning of the symptoms. The patient had never before noticed a lump in the groin. Operation under ether anesthesia. A vertical incision was made over the tumor, dividing the skin and subcutaneous tissue. There was found a tar-black mass projecting through the saphenous opening and situated within a thin transparent sac, which was supposed to be the peritoneal sac of a femoral hernia, and it was

¹¹ *Annals of Surgery*, March, 1919, p. 278.

expected that a gangrenous bowel would be found. On opening the thin sac there was found a lobulated mass, with a shiny surface though black, and apparently attached to the femoral ring, where it formed a narrow neck. The operator was much puzzled as to the nature of the strangulated mass, apparently situated in a peritoneal sac. He decided to divide Gimbernat's ligament, which he did by introducing the finger into the femoral ring, and the strangulated mass proved to be a fatty tumor surrounding the peritoneal sac. Hale does not believe that it was in the femoral sac at this time, although it had frequently occupied

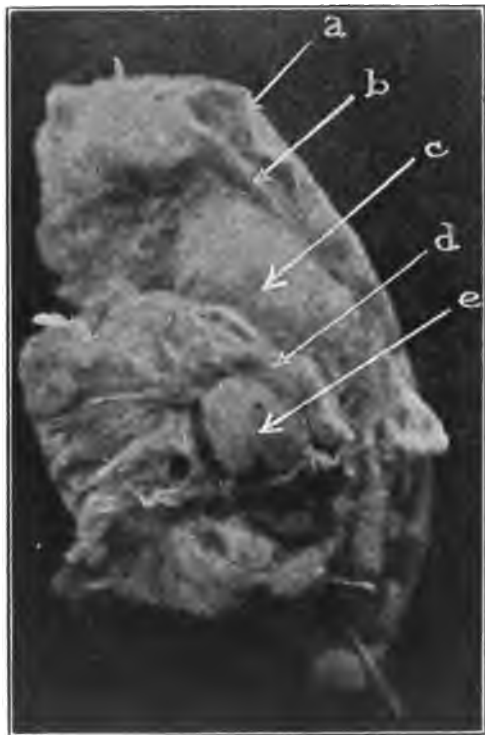


FIG. 26.—View of the umbilical region from inside. *a*, skin; *b*, superficial fascia; *c*, fat tumor external to superficial fascia; *d*, cut edge of linea alba; *e*, lobule of sub-peritoneal fat continuous with the tumor *c* through an aperture in the linea alba; *d*, no peritoneal sac.

this position. He states that the thin, transparent femoral sheath was the thing that had misled them all. It seemed to be identical with the femoral sac. The tumor was ligated and removed and the operation completed in the usual way. The patient made a good recovery.

This is an extremely interesting case. Yet Hale's careful description suggests the possibility that there might have been a loop of strangulated intestine or a Littre's hernia, which was either reduced by the hot applications just before the operation was begun or even during the operation while cutting through Gimbernat's ligament. If he was dealing with a Richter's or Littré's hernia, there would have been only a small loop of

intestine caught in the femoral ring, which might easily be reduced without recognition. This would seem a more reasonable explanation of the condition than to suppose a mass of fat overlying an empty sac could become suddenly strangulated and cause the acute symptoms of nausea, vomiting and severe pain within the short period of twenty-four hours.

I have personally seen a considerable number of cases of femoral hernia in which large masses of fat surrounded a small, empty femoral sac, but I have never seen these masses of fat dark-colored or semi-gangrenous in appearance, except in the presence of a strangulated portion of bowel which had been strangulated for twelve to twenty-four hours.

Inguinal Hernia. Among the rare cases of inguinal hernia should be noted a case of Deanesley, reported by Stidson,¹² Wolverhampton.

This was a case of left inguinal hernia in which the sac contained the pyloric end of the stomach plus cecum and appendix. The duration of the hernia had been eighteen years. During all this time he had occasional attacks of partial obstruction accompanied by vomiting and intestinal symptoms. On admission to the hospital he was very ill, almost moribund; he had been losing weight for two years. The hernia was about the size of an adult's head, partly reducible. The abdomen was greatly distended and hyperresonant.

Under general anesthesia the abdomen was opened above the umbilicus and an enormously distended stomach was found which occupied almost the entire abdominal cavity. Upon incision, three pints of liquid contents were evacuated, and a large amount of gas escaped. The pyloric end of the stomach could not be found. On introducing the arm into the abdominal cavity the pyloric portion of the stomach was found occupying the hernial sac, together with the cecum and appendix and a large amount of small intestine. The distal end of the stomach showed marked constriction corresponding to the neck of the sac.

The patient died within twenty hours. Autopsy showed the stomach two feet in length and capable of holding thirteen pints of water. There was no general visceroptosis.

Results of Operation for Radical Cure of Hernia at the Hospital for Ruptured and Crippled, New York. At the Hospital for Ruptured and Crippled during the year 1919 we have performed 712 operations for the radical cure of hernia. Of these, 543 were for indirect inguinal hernia in the male (263 in children with no recurrences and 280 in adults with 4 recurrences) and 72 in the female (38 in children with no recurrence and 34 in adults with 1 recurrence). Of the direct inguinal herniæ, 2 were in children and 39 in male adults, with no recurrence; 14 operations were performed for direct and indirect inguinal hernia, with 2 recurrences. Of 23 operations for femoral hernia, 8 were in males and 15 in females, with 1 recurrence. Umbilical, 10; of which 3 were in children and 7 in adults, with no recurrence. Ventral, 7: 2 in children and 5 in adults, with no recurrence; 1 operation was

¹² British Medical Journal, December 20, 1919, p. 813.

performed for epigastric hernia in a male child, without recurrence, and 1 for lumbar hernia in a male adult, without recurrence. Thirty-nine operations were performed for undescended testis, of which 5 were of the superficial inguinal type. Regarding the recurrences, 1 of the 4 which occurred in the indirect inguinal type, was a previous recurrence and should not be included in this year's statistics. Of course, these cannot be regarded as end-results, yet it should be remembered that the great majority of recurrences following operations for the radical cure of hernia take place within the first six months, and nearly all within the first year.

During the year 1919, three deaths have followed the operation for non-strangulated hernia at the Hospital for Ruptured and Crippled. This is the first mortality we have had in a number of years. Two of these three deaths were due to embolism; this is a striking fact, inasmuch as not a single case of embolism was found in the list of 8589 cases of hernia treated by radical operation reported by Dr. Hoguet and myself in 1918. The first of these cases, a male adult, operated upon for a double oblique inguinal hernia, died on the ninth day from pulmonary embolism. The second case was a very large umbilical hernia, in which death from pneumonia occurred on the fifth day. The third case was a male adult, operated upon for a left oblique inguinal hernia; he died on the sixth day of pulmonary embolism.

SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA:

By ABRAHAM O. WILENSKY, M.D.

THE art of surgery, especially when applied to intra-abdominal disease, has reached a high stage of development. The actual procedures with which individual operations are done, are fairly well standardized; and, as far as one can look ahead, it seems that the essential principles, upon which our methods of operating are based, will, probably, not be very materially modified in the years to come. The trend of research and investigation, as exhibited in the last years, is, apparently, taking other directions and is two fold: It comprises the effort to decrease, as far as is humanly possible, the dangers necessarily attendant to the operative procedures which, perhaps, the insufficiency of our knowledge still seem to make necessary, and to uncover the etiological causes of the various forms of disease; possibly the baring of the latter will result in the elimination of any form of surgical therapy.

The effort to increase the margin of safety of any operation is very necessary and very important; indications of this effort have been especially prominent in the last few years and in a number of different ways. We are learning better how to choose cases for operation that yield the best results; the choice is not being made wholly by the actual lesion itself but is being partly determined by associated conditions. These latter complications may, themselves, furnish sources of danger sufficient to jeopardize a life, which, without operation, might have continued with fair comfort for an indeterminate length of time.

Much progress has been made in the various forms and methods of anesthesia with the object of selecting for the individual case that which is safest and best. The postoperative complications, which are more or less directly due to the narcosis, are also receiving much attention and the attempt is constant to reduce these to a minimum or to obviate them altogether.

Methods—such as transfusion—competent to tide a patient over a dangerous interval or a perilous emergency are being employed more and more and with any procedure we are learning to conserve the patient's powers better by not subjecting them to too great an operative insult at any one moment.

Much more attention is constantly being paid to the late postoperative results. The importance of this cannot be overemphasized. Hitherto the operative procedures have not been sufficiently controlled, especially in gastric and intestinal surgery, with the actual permanent functional results. What changes are constantly being made in operative technic are, apparently, being initiated by the knowledge that functional

trouble has followed anatomical distortions resulting from operation, and improvements are constantly being devised to obviate these undesirable phases.

The war has furnished the medical and surgical world with a huge laboratory in which the experimental animals have been human beings. And yet the summation of the experience has impelled Blake¹ to speak of "a feeling of disappointment in regard to the influence the experience derived from the observation and treatment of wounds during the war had upon the development of surgical science. There has been little of new in the knowledge we have obtained. There has rather been a confirmation of principles already known, and the progress that has been achieved has been principally in stabilizing treatment rather than in making discoveries. I do not wish to imply that the page of progress has been blank. On the contrary . . . there has been fruitful investigations and observations, chiefly in regard to some of the infections and to shock. There has, however, been no development to change the underlying principles of wound treatment as recognized and practiced before the war. This, in view of the enormous amount of material afforded by the war, might be deemed an admission of failure; but when we reflect that the processes of repair in all wounds no matter what their cause, are essentially alike, and that these processes have been studied for a number of years, there is little ground for disappointment."

MILITARY ABDOMINAL SURGERY.

The consensus of opinion is that war wounds of the abdomen formed the most unsatisfactory group of all military injuries; the mortality was high and the responsibility was very great. No new change, or improvement in abdominal surgery has been brought forth as a result of the new experience. The importance of being able to judge correctly as to the presence of an intra-abdominal lesion, so as to eliminate needless abdominal exploration, is paramount. Except for learning to close abdomens without drainage, no new technic of any kind has been developed.²

Stassen³ emphasizes the fact that a man wounded in the abdomen is by no means out of danger after discharge from the evacuation centers with healed wounds; only exceptionally is the full physical capacity regained. Observation of five war laparotomies with an interval since operation of three years, of 17 with an interval of two years, of 8 with an interval of one year, has demonstrated that eventration, visceroptosis, disturbances from adhesions, and the flaring up of latent foci in the peritoneum lie in wait for these men; it is rarely that they escape one or more of these. In 10 per cent. an emergency laparotomy was subsequently required and of these nearly 33 per cent. had eventration. Stassen shows that there are different types of secondary disturbances and attempts to evaluate the degree of incapacity for each. Among

¹ *Annals of Surgery*, 1919, lxi, 453.

² *Journal of the American Medical Association*, 1919, lxxiii, 476. *Ibid.*, p. 187. *Indiana State Medical Association Journal*, 1919, xii, 225.

³ *Archives Médicales Belges*, Paris, 1918, lxxi, 507.

30 cases, 20 had to be trained in a new trade, one that would make less physical demands on the abdominal wall than the previous occupation. The new grades are in leather working, in mechanical drawing, printing, electricity and wireless telegraphy; the new occupations are those of furrier, tailor or domestic servant.

Two of the important sequels of war time abdominal wounds will, of course, be fecal fistula and intestinal obstruction. Both of these carry with them many dangers, the first from the possible infection associated with operations necessitating opening of the free peritoneal cavity, the second from the frequently fatal toxemias resulting from acute occlusion of the bowel.

Lockhart-Mummery⁴ has reviewed the *methods of closing fecal fistulae*. These can be crudely divided into two classes: Those in which a local plastic operation, without invasion of the free peritoneal cavity, obviates the danger of peritoneal infection and results fortunately in a permanent closure of the intestinal fistula; and, secondly, those in which it becomes necessary to open frankly into the peritoneal cavity, to liberate completely the affected loop, or loops, and then, with the mechanical conditions plainly in view, to deal adequately with the fistula either by plastic procedure or by complete resection. The usual course of affairs in the majority of instances, and perhaps in the less experienced hands, will progress from one, or, perhaps, more, local and minor plastic operations, in which great care will be taken not to invade the peritoneal space, to the final procedure in which the cure will be effected by bolder, and more radical, means involving a free laparotomy.

Many of the fistulae resulting from the primary injury or operation have, and will, no doubt, close spontaneously with judicious dressings and after patient waiting over periods usually extending to many months; these are the fortunate cases. In the others the trouble seems to be that the epithelium of the skin becomes continuous through the fistula with the epithelium of the intestinal tract; under such conditions it is practically impossible for spontaneous closure to occur. In a few of these the use of the actual cautery to destroy the epithelial lining for a short distance from the mouth of the sinus will accomplish a rapid contraction of the tract with subsequent healing; the permanency of the latter, however, depends on other associated conditions in the intestine distal to the site of exit of the fistula, and, when no stricture, or other obstruction, exists aboral to the latter, the cicatrization will be complete and no reopening of the sinus tract will probably interrupt its persistency.

The local plastic measures which are employed, involve an exposure of the opening in the bowel with closure of the latter by various ways of purse-string and burying sutures and with suture of the overlying skin in more or less of an indifferent manner; or the operation aims to close the fistula in the bowel and to make difficult its reopening by covering it with a maximum thickness of abdominal wall. In some types of operation a plastic of the abdominal skin and subcutaneous tissue is added by which the suture line in the latter is removed as far as possible

⁴ Surgery, Gynecology and Obstetrics, 1919, xxix, 312.

from the suture line in the bowel. A very good method for attaining such purpose was described by Beer several years ago: A wide flap of skin is lifted on a pedicle and displaced across the suture line in the bowel so that the latter lies under the center of the flap; the raw area left is covered by an additional flap taken from the side to which the first is displaced. According to Beer, this method has given him very good results; but as a general rule all of the local plastic operations for fecal fistula are more frequently, than not, fruitless of permanent healing.

CIVIL ABDOMINAL SURGERY.

The Abdominal Complications of Influenza. The literature of the past year has included quite a number of references to the abdominal complications of influenza. The indications are that these have been fairly frequent, much more so, perhaps, than individual experience would seem to lead one to believe. Several communications (Smith,⁵ Beals, Blanton and Eisendrath⁶) point out that in some of the patients the abdominal symptom-complex did not prove at autopsy to have been due to intra-abdominal anatomical lesions. Smith⁵ points out that in these pseudo-abdominal complexes there are observable criteria which serve to disavow any assumption of a true abdominal complication; these are as follows: (1) The movement of the ala nasi; in cases with no physical signs in the chest, movement of the ala nasi contradict any abdominal lesion. With the latter it occurs very late and with an advanced peritonitis. (2) Dulness in the flanks is never present in influenzal conditions except in the presence of an associated peritonitis. (3) The facies of the influenza victim dominates the picture; the anxiety is more lethargic and resigned. (4) In some of the cases, an unusually high temperature should be regarded with suspicion by the surgeon.

The clinical pictures of the complicating abdominal conditions, which were seen at Camp Custer, are grouped as follows by Beals, Blanton and Eisendrath:

1. *Abdominal Rigidity and Tenderness.* This was usually regarded as a reflex phenomenon from the thoracic condition; but in several cases which came to autopsy a localized subphrenic peritonitis was found. In a number of the patients pain in the right lower quadrant was noted; this also might be reflex; but in a certain number a true appendicitis was present.

2. *Peritonitis.* Of all the cases which came to autopsy, 4.2 per cent. showed an acute peritonitis. In one-third of these the process was localized; in the rest it was generalized. The fact that frequently the localization was limited to the upper half of the abdomen, suggests the theory that the infection traveled through the diaphragm. Hemolyzing streptococci were found in all; in some the bacteria were cultivated from the blood during life. The latter phenomenon suggests that frequently the peritoneal infection is hematogenous. In none of the cases was the appendix or gall-bladder especially involved. The diag-

⁵ Lancet, 1919, ii, 421.

⁶ Journal of the American Medical Association, 1919, lxxii, 850.

nosis was not made during life except in one of the cases. Suppurating peritonitis was not found in any of the early fulminating cases; possibly the time was too short for the development of this complication.

At Camp Beauregard, Frick⁷ reports that peritonitis was only seen once at autopsy.

3. *Jaundice.* Jaundice, with marked skin discoloration, was found in 7 per cent. of the necropsy cases—that is about equal to the frequency in fatal cases of ordinary lobar pneumonia. In all, except one, a bacteremia was present: The blood contained *Streptococcus hemolyticus* in 3; viridans in 3; pneumococcus IV in 2. In only 1 case was there any swelling of the ampulla of Vater; in this case the tumefaction extended up into the common bile duct. No evidence of obstruction was, however, ever demonstrated.

4. *Spleen.* In the majority the organ was somewhat enlarged, firm on section and predominatingly congested.

5. *Kidney.* Acute congestion was common; true acute nephritis was rare. In one, multiple abscesses accompanied a streptococcus bacteremia. Pyelitis was occasionally found and was demonstrated by ureteral catheterization. Both the renal and perirenal localization of the infection may be sufficiently severe to endanger life.

6. *Rupture of the rectus abdominis muscles* occurred with such frequency as to attract attention. The rupture occurred always midway between top and bottom of the muscle; it never was complete and was always bilateral; the amount of hemorrhage varied. The probable explanation furnished by Beals, Blanton and Eisendrath finds the cause of the rupture in an area of lessened resistance induced by infection. Confirmation of this explanation is found in the necropsy reports of Wolbach.⁸ Nine cases showed clearly defined areas of Senker degeneration in the rectus abdominis muscles with rupture of the muscle fibers and intramuscular hemorrhage. To a lesser degree the same process was observed in other muscles of the abdomen and of the chest wall. It seemed quite evident that the infection was blood-borne. The lesions presented themselves late in the disease, were not accompanied by evidence of a general sepsis, and were not readily diagnosed because they were unsuspected.

Rupture of the rectus abdominis muscles in influenza has also been noted by Baggart.⁹

Thrombophlebitis occurred in 2.7 per cent. of the Camp Custer cases. In 3 cases it was pulmonary; in one at the bifurcation of the vena cava; in one in the right iliac vein. Blood cultures were negative during life and after death. This complication is one of the late manifestations of the epidemic and occurred in those sick one or more months.

Lereboullet and Hutinel¹⁰ also report 10 cases of thrombophlebitis complicating influenza; in all of these the clinical course was comparatively mild.

⁷ American Journal of Medical Sciences, 1919, clviii, 68.

⁸ Transactions of American Surgical Association, 1919.

⁹ Lancet, London, 1919, ii (May 17, 1919).

¹⁰ Paris Médicale, 1919, ix, 7.

Next to empyema, the principal complication of surgical interest in the influenza epidemic at Camp Devens¹¹ occurred in a group of cases with localized abscesses, most often periarticular and intramuscular, and not involving the joints or any of the internal organs usually involved in metastatic processes. Of especial interest in this group were a number of cases of *abscess in the sheath of the rectus abdominis muscle*. These were first observed about a month after the onset of the pneumonia. Two patients had no other complication; a third had empyema and an abscess in the chest wall. Bacteriologically, all showed pneumococci—two, type 1; one, untyped. All recovered promptly after incision and drainage. Post-influenzal abscess in the sheath of the rectus muscle has also been seen by Gage and by the reviewer.

Smith¹² describes an *acute dilatation of the stomach* occurring at the height of an influenzal infection; this complication is extremely rare.

In two cases of influenzal pneumonia which came to autopsy, Nicolaysen¹³ found *duodenal ulcers*. To him the ulcers seemed to be quite recent and there seemed to be grounds for assuming that they were of infectious origin; diplostreptococci were found in the lungs and in the duodenal ulcers.

Cases of *acute appendicitis* complicating influenza have been reported by Porter¹⁴ and by Behrend.¹⁵ Porter's case was in a woman in whom the appendix abscess perforated through the vagina. The infection occurred at the termination of the influenzal attack. None of Behrend's cases gave a history of previous trouble in the appendix. In one, the appendix was found ruptured; in two, there was an empyema of the appendix. Five others were not operated upon owing to associated conditions in the lungs; it was feared that the pulmonary lesion would eventuate in a pneumonia. All of the patients recovered.

The observations of Tooth and Pringle¹⁶ among British troops in Northern Italy suggest that *jaundice* may occur as a complication of influenza. This complication has been reported more frequently among children, and Bronson¹⁷ has seen it three times following a typical attack of influenza. In 12 other cases an acute catarrhal jaundice developed in children who had been exposed to influenza but who had not had the disease in its typical form (Bronson).

Roussel and de Lavergne¹⁸ have also seen complicating jaundice in their influenza cases.

Johnson, Baufle and Coopt¹⁹ have seen a number of cases of *chronic colopathy* consecutive to an influenzal infection. These patients had an "acute enteritis" during the course of the disease; after convalescence

¹¹ Transactions of American Surgical Association, 1919. *Annals of Surgery*, 1919, lxx, 188.

¹² *Lancet*, London, 1919, xcvi, 421.

¹³ *Norsk Magazin for Lægeridenskaben*, Christiania, 1919, lxxx, 50; Abstract, *Journal of the American Medical Association*.

¹⁴ *Indiana State Medical Association Journal*, 1919, xii, 228.

¹⁵ *Surgery, Gynecology and Obstetrics*, 1919, xxviii, 601.

¹⁶ *Lancet*, London, 1919, ii, 148.

¹⁷ *British Journal of Children's Diseases*, 1919, xvi, 73.

¹⁸ *Bulletin de la Société Médicale des Hôpitaux*, Paris, 1919, xliii, 590.

¹⁹ *Lancet*, London, 1919, xcvi, 933.

they retained for several weeks a tendency to diarrhea with mucus in the stools, colics of moderate severity, and signs of intestinal irritability.

The possible evidence of disturbed function of the suprarenal glands as a cause of the asthenia present in all cases of influenza during the course of the disease and during the convalescence led Cowie and Beaven²⁰ to make an experimental investigation of this question. Necropsy reveals hypoplasia of the suprarenal and other structural evidence of suprarenal dysfunction. The occurrence of the latter may be regarded as indicated by the cardinal symptoms—asthenia and low blood-pressure—the characteristic rise of blood-pressure following the administration of epinephrin, and the subsequently prolonged blood-pressure curve. An endocrinal disturbance is further suggested by the prolonged blood-sugar curve following the administration of epinephrin. Hypoglycemia is not present in influenza as has been found to be the case in some diseases of endocrinal origin. However, therapeutic tests showed that, if epinephrin is of any use in the treatment of the symptoms of suprarenal dysfunction, the proper method of its administration seems not yet to have been found.

GENERAL CONSIDERATIONS IN ABDOMINAL SURGERY.

Surgical Prognosis. Miller²¹ made a study of 1000 case records classified as good, fair or poor surgical risks and was able to establish the degree of danger attending operations on the aged. The mortality-rate in the cases of 271 patients over fifty years of age was eight times as great as in 729 persons of less than fifty years of age.

In persons of forty, or more, years, who are to be subjected to operation, it seems to be advisable to study the heart's action by means of the electrocardiogram as a routine procedure. The demonstration of a complete arborization block should be accepted as definite evidence of the existence of a myocardial condition of such gravity as to make a distinct contra-indication to any operation which is not absolutely imperative. The experience of Wilius²² and others has shown that persons with this lesion have only a comparatively short time to live and that the dangers of anesthesia and operation are extreme.

Polak²³ urges that complete records be made of kidney function and blood-pressure in every case before deciding upon operation. The index of the cardiac muscle competency is shown by the relation of the pulse-pressure to the systolic pressure; this should be as one is to three, or more, if the compensation is adequate. The efficiency of the kidney function is directly dependent on the cardiac force of the individual, provided the kidney structures are normal, or approximately so. Ether anesthesia of one hour's duration does not disturb the relation of pulse-pressure to kidney function, unless the operation is accompanied by a considerable loss of blood. When the pre-operative kidney function is

²⁰ Archives of Internal Medicine, 1919, xxiv, 78.

²¹ Transactions of American Association of Anesthetists, 1919.

²² Archives of Internal Medicine, 1919, xxiii, 431.

²³ American Journal of Obstetrics and Diseases of Women and Children, 1919, lxxx, 113.

low, the pulse-pressure must be relatively high to compensate for the deficiency. When both the pulse-pressure and the phthalein output are low, or the relation between the pulse-pressure and the systolic pressure is as one is to two, the operative prognosis must be guarded. The pulse-pressure is a better index of hemorrhage or cardiac failure than the systolic pressure.

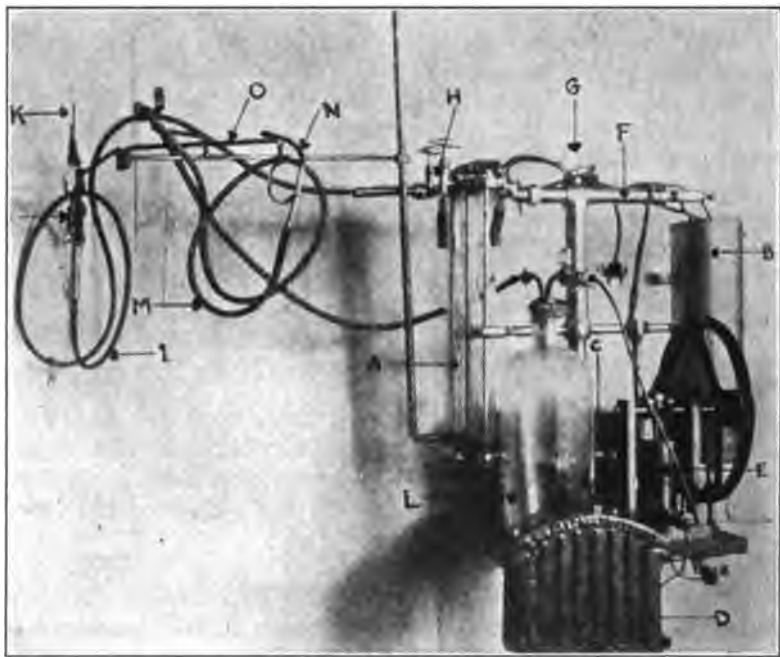


FIG. 27.—Pneumatic injector: *A*, glass cylinders for procain; *B*, pressure tank for compressed air; *C*, motor; *D*, rheostat; *E*, compression pump; *F*, cotton filter; *G*, air gauge; *H*, valves; *I*, flexible metal tubing; *J*, cut-off; *K*, needle; *L*, suction bottle; *M*, rubber tubing for suction; *N*, suction tip; *O*, towel rack. (Farr.)

Abdominal Surgery Under Local Anesthesia. Farr²⁴ described an apparatus—called a pneumatic ejector—with which infiltration of the parts with any local anesthetic is much facilitated. The instrument gives a constant flow of solution, controlled by a cut-off, which is said to be ideal from the standpoint of manipulation. The apparatus is shown in the illustrations. The ordinary abdominal wall can be anesthetized in two or three minutes and the average time from the beginning of the infiltration until the moment of incision is from five to seven minutes. Farr is rather enthusiastic about the use of local anesthesia for abdominal work and believes that “provided no other method is discovered to supplant general anesthesia, the latter will to a large degree be displaced by the local method.” The personal equation, however, enters so largely into the question that the advantage of the one over the

²⁴ Journal of the American Medical Association, 1919, lxxiii, 391.

other method, aside from the element of safety, will depend to a great extent upon the experience of the operator and, perhaps, to a much

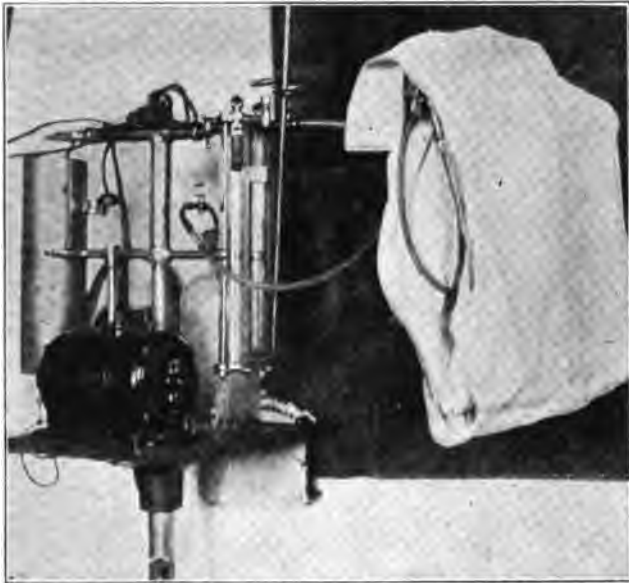


FIG. 28.—Pneumatic injector "set-up," filled and ready for use. Note sterile towel, protecting tube. By turning down the upper end of this towel we develop the diaphragm shown in Figs. 5 and 7. (Farr.)

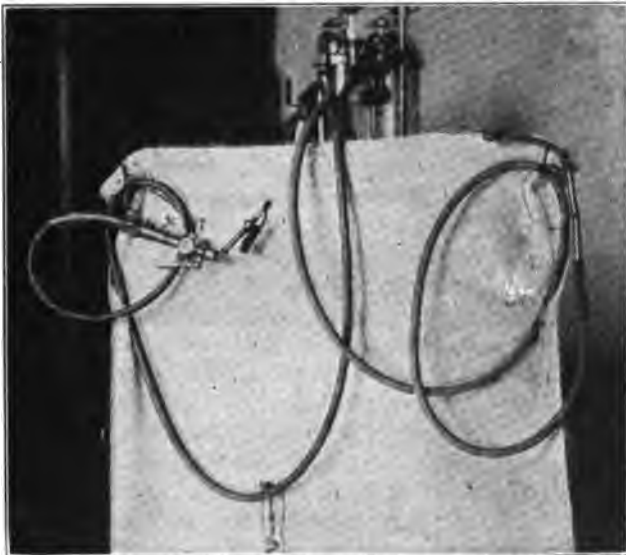


FIG. 29.—Pneumonic injector, cut-off and suction tubing within easy reach of surgeon's hand, and separated from the injector and anesthetist by sterile towel. (Farr.)

greater extent upon the nervous temperament and tolerance of the individual patient. At the present writing it seems that general anesthesia will always remain, except when definite incontrovertible contraindications form unarguable objections to its use, as a more humane, more efficient, less shocking and more superior method than any form of local analgesia.



FIG. 30.—Apparatus in use: Abdominal tumor delivered. Relative positions of anesthetist, patient, surgeon, pressure and suction tubing, with sterile towel as diaphragm definitely isolating the operating field. Injector is to the right, outside the field of the illustration. (Farr.)

General Anesthesia. Howell²⁵ did not find ether to be so efficient among the soldiers for purposes of general anesthesia; frequently he found it necessary to add chloroform. He believes this difference to have been due to excessive cigarette smoking. Chloroform made an ideal anesthetic and, when mixed with oxygen, its administration was much safer. The induction of narcosis under war time conditions needed much care.

Guthrie²⁶ advises the induction of anesthesia in the Trendelenburg position for operations upon the pelvic organs in order to minimize shock; it is said that shock is largely obviated by facilitating the falling back of the small intestine into the upper abdomen. The method is endorsed by Polak, Ochsner and Balfour; the latter two men raise the patient into the required position only after unconsciousness supervenes.

It is quite probable that the good effects noted in this method of producing anesthesia are directly attributable to the extraordinary regional distribution of the blood produced by the unaccustomed posture; a minimum of blood is present in the operative area, thereby entailing a minimal loss of blood; a maximum amount of blood is kept in those regions—brain and lungs—in which the circulation of an abundant

²⁵ Transactions of American Association of Anesthetists, 1919.

²⁶ Journal of the American Medical Association, 1919, lxxiii, 388.

supply of blood is conducive to the better support of the vital functions and, therefore, to a lessening of the number and intensity of the shock symptoms.

Attention has recently been paid to the normal and pathological physiology of the body economy during general anesthesia. Reimann²⁷ investigated the acid base regulatory mechanism during narcosis. In anesthesia there occurs a compensated acidosis in from 30 to 85 per cent. of the routine operated cases, and an uncompensated acidosis in from 15 to 20 per cent. The reduction in the bicarbonate content which has been found to occur after anesthesia and operation averaged from 5 to 15 c.c. of CO_2 per 100 c.c. of plasma. This decrease in the majority of the cases does not approach the limit of a compensated acidosis. It now seems thoroughly well established that the sum total of the ketone bodies in both the urine and blood after anesthesia and operation practically determines the amount of alkali which has been withdrawn from the available supply in the body. The protection of the patient from acidosis rests in limiting suboxidation and in supplying the body with alkali. Further studies have confirmed the previous observation that the ammonia and titrable acidity of the urine are increased after anesthesia. The acids are neutralized, as they are formed, by sodium bicarbonate and ammonia and also by other available, but less easily mobilizable, bases such as calcium and magnesium; the salts of the acids are then excreted and thus eliminated from the body. The symptoms, which acidosis will produce, vary in intensity from headache, nausea and vomiting, gas pains and mental dulness, to coma and death.

Clinically, acidosis plays an important part in an unfavorable post-operative symptomatology. The following factors are found to influence uncompensated acidosis: Extreme age, impaired kidney function, exhausting diseases, prolonged sepsis, the duration and depth of the anesthesia, hemorrhage and pre-operative fasting. The condition of shock is always associated with an uncompensated acidosis. It is important, clinically, to recognize that patients who show a low alkali reserve before operation will always show a greater diminution after operation. In handling the acidosis, a patient, who, before operation, showed a bicarbonate content of 58 c.c., or less, should be given the benefit of alkalization by means of sodium bicarbonate; further studies may, however, show the additional use of magnesium and calcium to be equally important. It must be remembered that too much alkali may do as much harm as an excessive acidity: a second analysis two hours after alkalization should, therefore, be made to indicate whether the desired result has been effected.

The toxic effects of general anesthetics in naturally nephropathic animals were studied by MacNider.²⁸ His experiments warrant the following conclusions: The use of an anesthetic is associated (1) with a reduction of the alkali reserve—which is very marked in naturally nephropathic individuals—and (2) with a decrease in kidney function; (3) if the alkali reserve can be kept above 7.9 the animals not only remain

²⁷ Transactions of American Association of Anesthetists, 1919.

²⁸ Ibid.

diuretic, but also responsive to diuretic solutions. Histologically, the animals with marked reduction of alkali reserve, anuria and non-response to diuretic drugs show a severe swelling and necrosis of the tubular epithelium of the kidney, especially in the convoluted tubules; the occurrence of large amounts of fat in these cells, especially in those of the ascending limb of Henle's loop has also been noticed.

The effect of anesthesia upon the nitrogen metabolism was investigated by Reimann and Hartman²⁹ in 90 patients. The urinary acidity was definitely increased in every one of the cases until, in some, almost one-half of the normal acid was excreted. The blood urea and non-protein nitrogen were increased in every case. In the urine the general tendency was for the ammonia to increase, whereas the excretion of urea was either increased or diminished with apparently no relation between the urea of the urine and that in the blood. The question of retention or increased production suggested itself in the case of the increase in the blood urea and non-protein nitrogen.

Chevrier³⁰ has conducted some investigations on the poisonous effects of general anesthetics on the liver functions. He shows that sugar and liver extracts, administered for one day, diminish the cholemia following a chloroform anesthesia to a minimum. A cholemia following the inhalation of ether is caused to disappear completely by similar means. When chloroform anesthesia is indicated, Davis and Whipple³¹ advised giving liberal amounts of carbohydrates and milk for at least two days preceding the anesthesia. They emphasize very strongly that it is dangerous to give chloroform to man, or animal, whenever a fasting period has preceded the administration of the drug.

An unhappy accident must have induced Bost³² to describe his method of heart massage in cases of anesthesia trouble on the operating table. An abdominal incision, four inches long, is made in the median line extending from above the umbilicus well up into the notch. The left costal cartilages are retracted strongly upward bringing the anterior diaphragmatic insertion well into view. A two-inch incision, beginning one inch from the median line and carried out behind the costal margin, cuts the fibers of the diaphragm near the insertion. A blunt instrument is pushed in and opens the pleural cavity; the opening is rapidly dilated with several fingers of the right hand until the whole hand can be passed into the thoracic cavity anterior to the pericardium. The hand is passed upward, the thumb behind the sternum and the fingers embracing the entire organ in the pericardium. The thumb compresses the right auricle and ventricle and the base of the heart is effectively massaged. No vessels are injured in this incision as the superior epigastric artery is internal to the incision and passes into the rectus muscle, and the musculophrenic branch enters the diaphragm through the cellular tissue behind the eighth and ninth costal cartilages to pass backward deeper than the incision. The liver and stomach, even if prominent,

²⁹ American Journal of Physiology, 1919, I, 82.

³⁰ Bulletin et mémoire de la Société de la Chirurgie de Paris, 1919, xlv, 735.

³¹ Archives of Internal Medicine, 1919, xxv, 612.

³² Indian Medical Gazette, Calcutta, 1919, liv, 50.

offer no obstruction, nor is the pericardium in danger of being opened. During the manipulations the parts are pressed around the wrist to prevent the sucking in of air.

Regional Anesthetics. Conductive anesthesia by intrasacral extradural injection of procain has been employed by Meeker.³³ The method consists of an extradural injection into the sacral canal. The motor roots are said not to be affected and retention of urine follows no more commonly than after ordinary methods. The field of usefulness is said to comprise operations for hemorrhoids, fistulae, and other perianal conditions: In some, the field of anesthesia comprises about three inches about the anus; in others, almost the whole of the buttocks are affected. The lower rectum is anesthetized for its lower three inches.

The injection is made through the center of the sacral hiatus.

A good deal has recently been written concerning spinal anesthesia, and the method seems to be growing in favor. The subject was discussed by Rood, Lockhart-Mummery and Cole at one of the meetings of the Royal Society of Medicine.³⁴ Of course, there is the disadvantage of having a conscious patient. When employed carefully and skilfully, however, the method seems safe, only 2 deaths being reported in 8000 cases; this compares very favorably with other methods of inducing analgesia. There seems to be a moderate fall of blood-pressure, but the fall is never excessive, nor peculiar to the new procedure. The interference with, or disturbance of, respiration is usually due to faulty technic in permitting the drug—usually stovain—to reach to too high a level. The vomiting which one sees is inconsequential. Rood spoke of the advantage of combining spinal with general anesthesia.

As with all other methods of anesthesia, accidents can be avoided by exercising a certain amount of care in selecting the patients. The method is never indicated in patients who are subject to attacks of syncope (such as those with aortic disease, etc.). Spinal anesthesia is used most advantageously in diabetics, or in those with advanced cardiac, pulmonary or renal disease; in these, it eliminates the dangers of a post-operative acidosis (Hepburn³⁵).

La Filliatre³⁶ has had an extensive war experience (abdominal) with spinal anesthesia: It gave him uniformly good results and never exhibited any alarming symptoms. Stanley³⁷ has also employed the method in 603 upper abdominal operations; no bad results were observed.

Hepburn³⁸ describes the method as it is used at the Montreal General Hospital. The following solution is employed: Stovain, 5 gm. and commercial glucose, 5 gm., dissolved in 95 mls. of physiologic sodium chloride solution. This mixture has a specific gravity of 1031 and a neutral reaction; it is kept in sealed glass ampoules of 2 mls. capacity. The dosage is regulated in accordance with the weight, age, and vitality of the patient; the maximum dosage is 0.07 gm. of stovain—or 1.4 mls.

³³ British Medical Journal, 1919, i, 569.

³⁴ Proceedings Royal Society of Medicine, 1919, xii, sect. anesth., 1.

³⁵ Transactions of American Association of Anesthetists, 1919.

³⁶ Bulletin de l'Académie de Médecine, Paris, 1919, lxxxii, 77.

³⁷ California State Journal of Medicine, 1919, xvii, 183.

of solution—and the minimal dose is 0.01 gm. of stovain. The injection is made under aseptic precautions in the third lumbar interspace after one, or two, drams of spinal fluid is released. The saline menstrum of the solution tends to neutralize the osmotic factor and the glucose exerts a cohesive action to counterbalance any diffusible tendency, so that the high specific gravity serves to carry the solution to the lowest dependent position of the spinal canal. Consequently the sitting, or semi-upright, posture during injection and operation are used for sacral anesthesia. The lateral posture, with hips and head elevated, is used for abdominal operations below the level of the umbilicus; the analgesic action is checked when the xiphoid is reached by quickly lowering the hips to the level of the table. For upper abdominal operations, the analgesia is allowed to ascend to the level of the fourth intercostal space. By continuing the elevation of the head and shoulders for six hours after operation, shock, faintness, respiratory distress and depression symptoms may be obviated entirely. The operative analgesia usually persists for a period varying from forty-five minutes to two hours. Stovain has been detected in the spinal fluid twenty-four hours, and in the urine seventy-two hours, after operation.

Achard³⁸ has had an extensive experience with spinal anesthesia, employing stovain in 123, and procain in 290 cases. Disturbing symptoms were headache, postoperative nausea and vomiting, brief syncope (4 per cent. of the procain, and 10 per cent. of the stovain cases), incontinence of sphincters (50 per cent.). The operations were all below the umbilicus. There was no fatal accident or durable injury.

Garcia³⁹ examined the spinal fluids obtained by lumbar puncture and released as soon as the patients exhibited symptoms of distress after the injection of cocain in the subarachnoid space; the fluid contained cocain. The symptoms subsided at once after the withdrawal of amounts of fluid averaging 40 c.c. In other patients the cerebrospinal fluid was released without waiting for the appearance of symptoms and none of these developed headache or any other distressing symptoms. The advisability of withdrawing spinal fluid at the slightest symptom of intolerance is obvious. The fluid can be withdrawn as soon as the analgesia is complete; it is not necessary to wait for the conclusion of the operation, as the analgesia, once installed, does not seem to lose in quality when this is done. If simple withdrawal of fluid does not arrest all of the disturbances, Garcia advises irrigating the spinal canal.

Shock. "Until a comprehensive and scientific definition of shock, based on known facts, is made, it seems best to classify all data bearing on the causes of sudden death, the causes of low blood-pressure and the phenomena of shock under the general term of surgical shock. A fact that is universally true of experimental work, and especially true in regard to shock should also be emphasized, namely, that direct clinical application of the experimental data should be cautiously made." (Mann.⁴⁰)

³⁸ Progrès Médicale, Paris, 1919, xxxiv, 239.

³⁹ Baceta de los Hospitales, Mexico, 1919, ii, 19 and 28; Abstract, Journal of the American Medical Association.

⁴⁰ American Journal of Physiology, 1919, xlvii, 231.

Shock has long been one of the mysteries in surgery, and, because of associated hemorrhage and infection, there is usually much difficulty in assigning proper values to the different agents which might produce the general state of depression. The war has furnished many contributions to our knowledge and understanding of the condition; the importance of any contribution to our knowledge of its causes and treatment can hardly be overestimated. No clear definition of the condition was available before the war; and the results of the extensive investigations which were carried out, has taught us that we were confusing a number of conditions—true surgical, or traumatic, shock, as we now understand it, psychical shock, and hemorrhage.⁴¹

Like many other phenomena of life and disease, shock is the result of the complex interplay of an unknown number of factors all of which are intimately bound together in the finished clinical picture. The circle of play of all of the various agencies is unbroken in health and the point of departure from the normal path may occur at any point of the circle; the distortion results in the shock-like state. It is not extraordinary that the different agencies at work should impress different observers with different degrees of intensity while the general similarity in the manifestations of the various phenomena are apparent to all. Confusion in thought is, therefore, inevitable; beliefs will be varied; hypotheses as to the essential nature of shock are as many as there are links in the chain: The unravelling seems to tend toward the recognition of the fact that a shock-like state may be initiated by any one of a number of interlocking factors while the general manifestations of the clinical picture remains approximately the same.

Cowell⁴² calls attention to the following factors which can be demonstrated in any established case of shock:

1. Pre-wound factors of fatigue, exposure, lack of fluids and presence of excitement.
2. Capillary stasis and increased permeability of vessels.
3. The effects of hemorrhage, including the reduction of blood volume following the loss of blood.
4. Absorption of toxic products from infected or damaged tissue, or from both combined.
5. Possibly, also, a toxemia from hypersecretion of adrenalin.
6. Post-wound factors of pain, hemorrhage, cold, etc.
7. Diminution of intracellular oxygenation, leading to irrecoverable damage of the finer nerve cells.
8. Presence of acidosis in blood (reduction of alkali reserve).
9. Profound lowering of body temperatures.
10. Toxic action of certain anesthetics.

All of these form a vicious circle and, when the latter is once established, efficient treatment is difficult.

An examination was made by Erlanger and Gasser⁴³ of the *mechanical changes in the circulation occurring in shock* as induced by procedures

⁴¹ Journal of the American Medical Association, 1919, lxxiii, 174.

⁴² Lancet, 1919, cxcvii, 137.

⁴³ American Journal of Physiology, 1919, xlix, 151.

directly involving the abdominal viscera, that is to say, in the type of shock most commonly investigated. They found that properly graded temporary artificial obstruction of the inferior vena cava above the liver, or of the aorta beyond the origin of the left subclavian artery, eventually results in the development of a condition closely resembling traumatic shock. They are convinced that the failure of the circulation after both of these manipulations is, in part certainly, due to the consequent sequestration of corpuscles in the capillaries and venules, and that if back-pressure in the veins, such as is produced by caval obstruction, is a factor in the development of this state of affairs, in the capillaries and veins it is not an essential one. The fact that the vasomotor mechanism need not be involved (as, for example, in aortic obstruction) renders it unnecessary to invoke failure of a nervous venopressor mechanism to explain the fulness of the capillaries and venules. It can be explained on the basis either of a change in character of the blood stream, or respiratory and nutritional changes in the vessel walls or, more probably, on the basis of both.

The changes occurring in the systemic venous system are so small that they cannot be regarded as significant, excepting, perhaps, in demonstrating that cardiac failure has little, if anything, to do with the failure of the circulation. The portal venous pressure falls continuously, though slowly, during the first few hours. It then ceases to fall, or rises, actually, slightly, until the arterial pressure has reached a comparatively low level, when the portal pressure again begins to decline. The peripheral resistance, both somatic and splanchnic, is, at first, practically invariably increased. At about the time the arterial pressure begins to fall and, also, about the time the portal pressure begins to rise, the peripheral resistance begins to diminish, and, by the time the arterial pressure has reached the vicinity of 50 mm. Hg., the peripheral resistance is below normal. But up to the time of death the vessels and vasomotor center preserve some residual tone, although slight activity is exhibited. In this respect the findings of Bartlett are completely confirmed. No positive evidence has been obtained that the efficiency of the heart has been impaired during the development of shock. Nevertheless, although the heart is capable of raising the arterial pressure as high as the normal heart can, Erlanger, Gasser and Gesell⁴⁴ are of the opinion that it cannot maintain high pressure as long as the normal heart can.

The initial changes in the circulation can be explained best on the assumption that the effective blood-volume is reduced. A considerable loss of fluid from the exposed bowel occurs in the experimental animals as a result of transudation through the serous surface, and, presumably, into the tissues also. The capillaries and veins of the intestinal villi are greatly distended and tightly packed with corpuscles. The loss of fluid into and through the tissues of the bowel and the sequestration of blood in the intestinal capillaries and venules suggest a mechanism through which a reduction in blood-volume might occur. Gasser, Erlanger and Meek⁴⁵ found that the effective blood-volume may be

⁴⁴ American Journal of Physiology, 1919, xlix, 90.

⁴⁵ Ibid., 1, 31.

reduced in the following ways: (1) By transudation of plasma; (2) by transudation of plasma combined with jamming of the corpuscles in the capillaries and venules; (3) the latter combined with absolute stasis in some part of the vascular system; (4) hemorrhage into tissue, especially into the lumen of the intestines; (5) by dilatation of the capillaries with great slowing of the circulation—this is always accompanied by some loss of plasma which, however, is inconsequential.

On the basis of animal experimentation made by themselves and others on the mechanism of shock, Erlanger and Gasser⁴⁶ conclude that the slowing of the circulation in a considerable part of, or in the whole body, is commonly, if not always, the factor that leads to the development of experimental shock. It is believed that as a result of the slowing of the blood-stream the blood corpuscles become clumped in the venules and capillaries which then become choked with solid masses of corpuscles and dilate. The blood flow is then curtailed much more, in fact, to the point of interfering seriously with the processes of tissue respiration and nutrition. The effective blood-volume is reduced not alone by dilatation but also by transudation of plasma. The organism strives to combat this real and effective reduction in blood-volume by the usual mechanism of pouring out tissue fluid into the blood-stream. Largely, if not exclusively, as a result of a deficient general circulation, resulting from reduction in effective blood-volume, the medullary centers, including the vasomotor centers and the heart, eventually show some signs of functional insufficiency.

The observations of Lee⁴⁷ seem to support the *importance of blood-volume* in hemorrhage and shock. Profound disturbances of blood-volume are always serious, and, if maintained for any considerable time, are usually associated with death. Blood-volume can be estimated easily and roughly by comparative readings of the hemoglobin content before and after the intravenous infusion of a known amount of fluid. A general study of blood-volume strongly suggests certain procedures which may be utilized for the prevention and control of hemorrhage and shock. Continued observations of blood-volume give valuable information in regard to the prognosis.

Regarding these observations, the studies of Dale and Laidlaw⁴⁸ throw considerable additional light. In working with histamin they noted that its local application was followed by a localized area of edematous swelling and redness. Translated into anatomical terms these changes correspond to a widening of capillary lumina and the opening up of those which are normally not visible, to a tendency to blood stasis, and to an abnormal permeability of the lining endothelium which permits an excessive transudation of blood-plasma. The apparent unimportance of these consequences, when the area of irritation is insignificant in the total body economy, disappears when the chemical is sufficiently large to influence large areas; then a circulatory collapse ensues comparable in its manifestations and effects to the ordinary phenomena of shock.

⁴⁶ *Annals of Surgery*, 1919, lxi, 389.

⁴⁷ *American Journal of Medical Sciences*, 1919, clviii, 570.

⁴⁸ *American Journal of Physiology*, 1919, lii, 355.

A large field for speculation is opened by the observations of Dale and Laidlaw: Whether inflammatory processes and shock make use of the same mechanism; whether these two conditions are different degrees of one another; whether either process results from a localized or general poisoning of capillary endothelium by chemical bodies introduced from without, or resulting from some endogenous activity; whether the last is not some endocrine activity normally kept under complete control, or whether the activity involves the destruction of normal body tissues with a resultant formation of a biological intoxicant. The value of the observations assumes an added significance when compared with shock-like states which have been seen to follow the intravenous introduction of certain drugs, notably those of the new group of arsenic preparations. Other evidence is present to show that circulatory failure can be due to epinephrin.

The experiments reported by Erlanger and Gasser⁴⁹ in this regard show that the injection of *adrenalin* for periods of twenty to thirty minutes at such a rate as to maintain high arterial pressure, invariably constricts the arteries of both the somatic and splanchnic areas. After sufficiently large doses the arterial pressure, barring occasional intercurrent phenomena, falls steadily and slowly until the animal dies. The failure is attributed to the extreme slowing of the blood flow due to the constriction of the arteries.

Most interesting and valuable are the latest studies which indicate the *toxicity of the products of destruction of muscle tissue*. As Cowell⁵⁰ pointed out, shock in warfare is generally associated with large wounds, with extensive destruction and shredding of tissue; some of these injuries are sure to prove fatal very quickly. The experimental work described seems to show that a pressure-lowering substance passes from the traumatized tissue to the rest of the body by way of the circulation; extravasation of blood may augment the depressant effect. Other evidence shows that whatever this substance is, it is fairly promptly changed in the body so that its effect is not permanent. The clinical experience of McCartney⁵¹ is in accord with this: McCartney believes that his "traumatic toxemia" is one of the main features of secondary wound shock.

Quenu⁵² gave an interesting report of some investigations of Pierre Delbet⁵² on the toxicity of lacerated muscles from the standpoint of the genesis of shock. Delbet removed the crushed and lacerated muscles of 121 animals, including rabbits, rats, mice, eels and frogs, and injected the filtrate of these tissues into 213 animals. Toxic effects were noted in every instance, and the animals developed polypnea, disappearance of the reflexes, and coma; frequently the phenomena terminated in death. Recovery is possible even after coma sets in. The early deaths which supervened, in from five minutes to six hours after injection without the animal coming out of coma, seem to be due

⁴⁹ American Journal of Physiology, 1919, xlix, 345.

⁵⁰ Journal of the American Medical Association, 1918, lxx, 607.

⁵¹ Edinburgh Medical Journal, 1919, xxiii, 157.

⁵² Academy of Sciences, Paris; Journal of the American Medical Association, 1919, lxxiii, 925.

to the intoxication of the cerebral and bulbar nerve centers. The retarded deaths, which take place after the animals have recovered from the coma, are due mainly to liver alterations. Muscular tissue infected with the streptococcus, the staphylococcus, the proteus or the pyocyaneus bacillus appeared to be less toxic than the aseptic tissue. The toxic effects were always of the same type, but they vary greatly in intensity. The same character of dose may produce insignificant results or may have a mortal effect. Gray rats or frogs, which are eminently carnivorous, proved much more susceptible than guinea-pigs, which are herbivorous. These latter facts, developed by experiment, led to a suspicion that, possibly, the strong meat diet of the soldiers was one of the causes of the frequent severe symptoms of shock during the war.

The importance of this phase of the problem was shown by Cannon⁴² in a series of experiments in which the shock-like state, which invariably followed the creation of a badly crushed limb, could be entirely averted by blocking the circulation draining the affected part. The experiments seem conclusive. Cannon's work was accepted by the English Research Committee on Shock: The Committee was impressed with the highly important role "traumatic toxemia" played in causing shock after war wounds.

Moore⁴³ claims that the general viewpoint on the *chemical conditions in shock* is all wrong, and that is why the underlying "acidosis," which is invariably present and to which, at first, much attention was given, seemingly became later neglected. All cases of secondary wound shock show not an "acidosis" but an "alkalosis." For that reason all attempts of physiologists to mimic the condition have been futile. When the pressure of carbonic acid in the blood is decreased, then alkalinity arises and kidneys and tissue cells strive to remove alkali from the circulation; hence the circulating bicarbonate decreases, and lowered titration figures are obtained; the blood is, however, more alkaline. A fall of bicarbonate reserve to one-third of the normal can be caused by a small fall in pressure of carbonic acid. When primary shock occurs from sudden heart failure, from emotional causes, from hemorrhage, from pain, or from some other stimulus, there is cerebral anemia and unconsciousness; a general cessation of metabolic activity ensues at first, later the depreciation amounts to one-third of the normal rate. An excess of carbon dioxide over that produced must be removed in the lungs and the blood necessarily becomes alkaline; this is what occurs in secondary shock. During the period of fainting, both heart and respiration are held in abeyance, the heart, perhaps, more so than the respiration; at first the venous condition favors recovery, but later respiration exceeds the circulatory effort and the blood becomes more alkaline and carries more shock stimuli to the nerve centers and heart. If, as a result of a primary shock, the circulation is working at one-third of its normal rate, and the respiration is going on at the usual rate, the amount of carbon dioxide produced will only be one-third of the normal while elimination

⁴³ Lancet, London, 1919, ii, 473.

proceeds at the normal rate. The result must be an increase in the alkalinity of the blood and a consequent failure of the heart. Hyperpnea need not necessarily be an antecedent factor to surgical shock.

The work of Araki⁵⁴ has shown that any circumstance which diminishes the oxygen supply of the tissues tends to diminish the alkali reserve and that conversely the state of shock with diminution of alkali reserve indicates a danger arising from insufficient oxygen supply. These facts form a basis for the similarity which has been repeatedly noted between the phenomena of shock and hemorrhage, because when the blood-pressure has once been lowered in shock the effect on the body is in all respects similar to that produced by an extensive loss of blood. In some recent experiments it was noted that the reduction in blood-pressure to 70, 60 or 50 mm. Hg. causes, at the end of thirty minutes, a reduction of the alkali reserve; but it was further noted that this reduction of the alkali reserve had no serious effect in augmenting the shock-like condition.

In resuscitation work the treatment of three phenomena only has yielded successful results: (a) The lowered body temperature; (b) the lowered blood-pressure; and (c) the diminution of blood-volume. McCartney⁵¹ emphasizes that it is the cases of hemorrhage combined with little shock which furnish the successes in resuscitation work, and that the treatment of acidosis by intravenous injection of sodium bicarbonate has little or no practical value in cases of shock.

Cannon⁴² points out the *important points in therapy* which his observations seems to convey:

1. The application of a tourniquet to avoid absorption into the body of the harmful substances from a hopelessly destroyed area and not to remove it before operating proximal to the constriction. The reason for the latter is that tissues deprived of their blood supply undergo the same changes, though more slowly to be sure.

2. The loss of heat is to be prevented by avoiding unnecessary exposure of the body, and by conserving the body's heat by hot drinks, hot bottles, and by proper blanketing.

3. The damaging effects of continued low blood-pressure should be avoided: if, by the end of a half hour, the blood-pressure is not above the critical one of 80 to 90 mm. Hg., the case should be treated as one of hemorrhage and the treatment should be prompt. The best method for this is transfusion of blood; the next best medium after blood is Bayliss's solution or Erlanger and Gasser's modification of this solution.

4. It should be clear that morphine ought not to be given in such amount as greatly to retard respiration; and that in all stages deep anesthesia, cyanosis, or such rebreathing as would diminish the oxygen supply of the respired air should be scrupulously avoided.

Mann's⁵⁵ experiments confirm the opinion that drugs are of little avail. The use of heat is important; but above all the best results are obtained by the injection of fluid media and the data of his experiments justify the conclusion that none of the artificial media give as good results as blood.

⁵⁴ Zeitschrift für physiologische Chemie, 1891, xv, 335.

⁵⁵ American Journal of Physiology, 1919, 1, 86.

Most of the interest has centered about the methods of restoring blood-volume and of increasing the oxygen-carrying constituent of the blood. For this purpose *transfusion* of blood holds a paramount place. The good effects of transfusion was especially valuable in the war work and, according to Lacoste, Lartigaut and Picque,⁵⁶ it helped more than anything else to bring more of the wounded into an operable condition. The same effect was noted also in both the British and American armies. There is no reason why the same should not hold true in civil life and with many of the ordinary surgical diseases.

Picque⁵⁷ made use of the following guides in transfusion: (1) The clinical examination of the patient; (2) the blood-count; this was normal however, in one-third of the cases at the front in the first six hours; (3) the blood-pressure; this was the best method and transfusion could be done before or after operation. The transfusion was only done in those in whom it was judged that the operation could eliminate any infection which was present.

Whatever discussion has taken place concerning the relative merits of unchanged and of citrated blood, seems to have had little effect on the practices in use in the various armies; under war time conditions, the citrate method had so many advantages from its ease of application that in the various armies the method became official. In a civil environment the advantages of the one over the other method would, however, be debated upon individual merit rather than upon the facility with which the procedure could be carried out. In conditions of hemorrhage and shock, where the object is to replace the loss of, or to make an addition to, a normal blood in the presence of normal blood-making organs, the majority of opinion leans to the view that, for this purpose, the citrate method holds an equal place with any of the methods making use of unadulterated blood.

One of the disadvantages of the citrate method is that a greater number of patients develop chills, subsequent to the transfusion, than do after the introduction of unchanged blood. At the Mayo Clinic this disadvantage has disappeared to a great extent following a practice introduced by Butsch of withholding all food and drink from the donors for a period of five or six hours prior to the transfusion. (The reviewer is indebted to Dr. Lewisohn for this information.)

Frequently the good effects of the transfused blood must be enhanced by a further addition of isotonic fluid both because the amount of blood available for transfusion is insufficient and because the additional fluid element is very essential. For the latter purpose Erlanger and Gasser's modification of Bayliss' solution (hypertonic gum acacia and glucose) seems the best. While investigating the comparative action of glucose and gum acacia, Gasser and Erlanger⁵⁸ found that after the injection of an 18 per cent. solution of glucose, the average increase in blood volume amounts to one-half of the theoretical maximum; the blood returned

⁵⁶ Société de Chirurgie, de Paris, 1919.

⁵⁷ Transactions of American Medical Association; Journal of the American Medical Association, 1919, lxxiii, 180.

⁵⁸ American Journal of Physiology, 1919, l, 104.

to its normal concentration in from five to forty-five minutes. After the injection of a concentrated gum acacia solution, the average increase of blood-volume amounts to 41.7 per cent. of the theoretical maximum; the action, however, is prolonged to from two and one-half to six or more hours. When both the solutions are used, the average increase in blood-volume attained is at a maximum and is much greater than from either constituent alone. Comparable results follow when sodium bicarbonate solution, of an equal osmotic tension with 18 per cent. glucose, is substituted for the latter; the combination of gum and alkali, unfortunately, exhibits certain harmful effects in hampering the circulation. The disadvantage is entirely absent with acacia-glucose solutions, and, when the latter is given in appropriate amounts, better results are obtained in animals than with other combinations. Erlanger and Gassser⁵⁹ determined further that the hypertonic gum acacia and glucose solution was not contra-indicated even when the shock-like state was complicated with dangerous hemorrhage.

The administration of this solution under the indicated circumstances acts, according to Erlanger and Gasser,⁶⁰ in the following manner: (1) by withdrawing fluids from the tissues into the blood stream, thus assisting the normal mechanism of restoring blood-volume; (2) by maintaining this increase through some property of the gum solution; (3) by dilating the arterioles through some specific action of the hypertonic crystalloid; (4) by increasing the energy of the heart-beat in the same way, and by the action of glucose on muscle; (5) by augmenting metabolism through the increase of glucose between the limits of basal metabolism and self-regulation.

There is no need of providing salts with this solution because the latter is given in such small quantity (5 c.c. per kg. of body weight) and so very slowly. The withdrawal of water from the tissues seems to do no harm, probably because of the large supply available; and the loss, which does occur, can, and should, be made good by water administered by mouth, by rectum or under the skin. The results obtained through the use of the solution in 12 cases of shock and hemorrhage in man, show conclusively that the solution is innocuous and they strongly suggest the beneficial action.

A large number of preparations of the various gum-salt solutions, made at the central laboratory of the United States Army Medical Department and used in resuscitation work, were subjected to toxicity tests in guinea-pigs by DeKruif.⁶¹ The aim of the experiments was to discover whether these solutions might possess the "equilibrium disturbing" effect that certain substances in the colloidal state show when injected into the circulation. With one exception no anaphylactic effects were seen. Slight symptoms of various kinds, which followed the injection of massive doses of certain samples, were of so little importance that they could be disregarded. The exception mentioned was that of a sample contaminated with *Staphylococcus aureus* and an

⁵⁹ American Journal of Physiology, 1919, 1, p. 149.

⁶⁰ Idem.

⁶¹ Annals of Surgery, 1919, lxi 297.

unidentified bacillus. Severe effects followed the injection of this preparation. One guinea-pig succumbed with typical anaphylactic symptoms. This animal was not a normal one but, at necropsy, was shown to be pneumonic. Normal harmless gums, seeded with organisms isolated from the preparation just described, showed some increase in toxicity which was not, however, as marked as that of the original sample. Out of the thirty-five samples tested for sterility, three were found to be contaminated; this is a serious indictment of the methods of control employed by those making the gum solutions. Attempts to produce a toxic element in gum solutions by subjecting them to cold, failed. Attempts to make normal rat and guinea-pig serums "anaphylactic" with various samples of gum did not succeed. This furnishes important confirmatory evidence of the harmlessness, as far as the anaphylactic effect is concerned, of the gum solutions.

THE EFFECTS OF ANESTHESIA IN CONDITIONS OF SHOCK AND HEMORRHAGE. The hesitancy to operate upon patients who are exhibiting the phenomena of shock, or of a shock-like state, is due to the fact that the blood-pressure falls to a perilous extent during the surgical procedure. In a series of cases studied, Cannon²² found that the blood-pressure fell, during operation, from 88 systolic to 62, and from 62 diastolic to 31—a calamitous drop when one considers that the pressure was already so low as to barely be enough to keep the tissues properly supplied with oxygen. Accompanying this fall was a marked drop in the carbon dioxide content of the blood-plasma.

It was found in the laboratory that these imperilling conditions were largely due to the anesthesia. Animals were used experimentally to test the effects of the several usual anesthetics in shock-like conditions. Under ether there was an invariable, and marked, fall in blood-pressure. Under nitrous oxide-oxygen the effect depended on the relative amounts of the gases in the mixtures. In a ratio of 6 to 1 the effect of nitrous oxide-oxygen was almost that of ether. Ratios of 5 to 1 and 4 to 1 also precipitated falls in blood-pressure. The effect of a 3 to 1 ratio becomes negligible. There is no doubt that nitrous oxide-oxygen is the anesthetic of choice in conditions associated with shock and hemorrhage, especially when given with the greatest possible admixture of oxygen. If morphine is previously given, the amount of nitrous oxide can be further reduced.

Under ether anesthesia the blood-pressure can be sustained by starting transfusion or infusion at the beginning of the operation and by continuing it gradually while the operation is going on. Pressure is thus kept to a proper level, the blood stream is kept going with no reduction in its rapidity, and the shocked person gets through the operation in much better shape than would otherwise be possible.

The probabilities are that in the course of a short time nitrous oxide-oxygen anesthesia will displace all the others for the routine production of narcosis as being the least dangerous; ether will probably be retained for adjuvant purposes.

Effect of External Heat and Cold on the Abdominal Organs. Heat and cold are commonly applied to the exterior of the abdomen in the belief

²² Transactions of American Association of Anesthetists, 1919.

that some beneficial influence is exerted thereby upon the contained abdominal contents. Ludin's⁶³ observations go to show that both heat and cold applied as indicated exert very little influence upon the viscera. For instance, the results of clinical and experimental study on the physiologic and therapeutic action of heat applied in the general region of the stomach is as follows: In 151 tests on 23 patients, no modification of the composition of the gastric juice could be shown. Roentgen examination of the stomachs of 50 patients showed that the heat promoted the motor activity slightly; with organic pyloric stenosis the evacuation of the stomach contents was not accelerated. In 9 other patients with open ulcers and pyloric spasm, the time of emptying was materially shortened. The last finding explains the relief of pain which follows the application of heat.

General Operative Considerations. In previous years PROGRESSIVE MEDICINE has called attention to the excessive and, perhaps, needless *preparation of patients* before operation involving the forcible emptying of the bowel by purgative drugs. In the last year or two, Alvarez has called especial attention to this subject.

Moore⁶⁴ regards the *enema* as a more physiological method for pre-operative preparation than a purge. His routine procedure is to have the patient take food as usual up to, and including, the evening meal of the day preceding operation. Following the latter, and before bedtime, an ordinary soap-suds enema of one quart is given and repeated at six or seven o'clock of the following morning. Plenty of water is given during the night and should be given at intervals during the morning whether desired or not. Moore has noted that postanesthetic nausea is less frequent following this method of preparation as a result of the fluids having been left in the tissues to be handled in the usual way.

Even this preparation seems to be not very essential and the reviewer for a number of years has made it a practice, where possible, of omitting any intestinal preparation at all prior to operation. Only when no bowel evacuation has taken place for a number of days prior, is a low enema given on the evening preceeding operation. In the major intestinal cases, where a long period of obstipation must necessarily follow in the postoperative period, whatever purging of the bowel seems imperative is most advantageously done a number of days prior to the day of operation; the important point seems to be that at least twenty-four, and better still forty-eight, hours be permitted to elapse after the bowel has been evacuated, to allow of a reestablishment of the normal intra-intestinal equilibrium.

ANTISEPTIC SOLUTIONS. According to Sollman⁶⁵ the presence of potassium iodide in the official tincture of iodine does not seem to render the solutions more irritating. On the contrary, the compound solution is somewhat less irritating to the skin and much less precipitant to the proteins than the simple alcoholic tincture, or the secret and non-

⁶³ Correspondenz-Blatt für Schweizer Aerzte, Basel, 1919, xlix, 1085.

⁶⁴ Texas State Journal of Medicine, 1919, xiv, 295.

⁶⁵ Journal of the American Medical Association, 1919, lxxiii, 899.

secret "miscible mixtures." The more even spreading and the more rapid coagulation of protein render the simple alcoholic solution the best for the disinfection of the skin; while the delayed protein precipitation by the U. S. P. tincture would render this somewhat superior for the disinfection of open wounds. The secret and non-secret "water soluble tinctures" do not appear to have any material advantage.

Gibson⁶⁶ has found that a 2 per cent. solution of *picric acid* has decided advantages over the iodine tinctures for the preparation of the site of operation, in that the solution is much less irritating than the iodine tincture while it is equally as efficacious.

Pilcher⁶⁷ has a new antiseptic solution for use in extensive (war) injuries. *Quinine formaldehyde* solution is simple and stable; it can be concentrated for transportation, and its strength can easily be increased or diminished; it can be used at an early stage of wound treatment. The solution contains the following ingredients:

Quinine sulphate	1.0 gm.
Hydrochloric acid	0.50 c.c.
Glacial acetic acid (90 per cent.)	5.0 c.c.
Sodium chloride	17.50 gm.
Solution of formaldehyde (aqueous)	1.0 c.c.
Thymol	0.25 gm.
Alcohol (90 per cent.)	15.0 c.c.
Water	q. s. ad 1 liter.

The directions are: (1) Dissolve the quinine in the hydrochloric acid; (2) dissolve the sodium chloride in water; (3) dissolve the thymol in the alcohol; (4) add 1 and 2, then formaldehyde, then thymol. The solution is used as in the Carrel technic.

HEMORRHAGE. An investigation made by Haessler and Stebbins⁶⁸ deals with the question whether, or not, bile salts, present in the blood in jaundice, are in themselves capable of causing an increase in the coagulation-time. They found that within certain limits clotting-time depends on the percentage of bile present in solution and that the reaction is the same in experiments with pure solutions of the substances concerned in coagulation as in whole plasma. Apparently bile and bile salts do not interfere with the formation of thrombin, since the prolongation of clotting-time is just as great when preformed thrombin is added in ample quantity to a fibrinogen solution as when thrombin must be formed from its precursors in the presence of bile. It was found that a retardation of clotting, great enough to be detected by clinical methods, took place with amounts of bile greater than 5 per cent. The relation of bile pigment and bile salts in the blood in jaundice has not been determined, but to Haessler and Stebbins it seems possible for the salt to be present in sufficient concentration to prevent clotting.

Dufour and LeHello⁶⁹ noted that an anaphylactic reaction in a patient with hemorrhagic purpura seemed to modify the blood in such

⁶⁶ *Annals of Surgery*, 1919, lxi, 127.

⁶⁷ *Ibid.*, lxviii, 467.

⁶⁸ *Journal of Experimental Medicine*, 1919, xxix, 445.

⁶⁹ *Presse Médicale*, 1919, xxvii, 553.

a way as to arrest the tendency to hemorrhage. This suggested to them that a therapeutic anaphylaxis might be induced which would arrest hemorrhage uncontrollable by other means. They selected for this the method of passive anaphylaxis induced by injections of small amounts of serum from a rabbit in a state of anaphylaxis. Several rabbits were injected at regular intervals with small doses of diphtheria antitoxin by the venous route. The animals were bled on the twenty-first day after the first injection and their serum, injected into guinea-pigs, sensitized the latter immediately and induced manifest hypercoagulability. Injected subcutaneously into humans, the "seric-serum" almost immediately induced hypercoagulability and in numerous cases it arrested hemorrhage in grave hemophilic conditions, in postoperative bleeding, in severe recurring uterine hemorrhage, and in severe epistaxis. Nothing to compare with this prompt arrest of the tendency to hemorrhage has ever been realized by Dufour and LeHello with other measures. The "seric-serum" was injected in doses of 10 c.c., and the effect was evident in from one to four hours in the different cases. In none of the patients were more than two injections needed.

Postoperative Parotitis. Several communications have appeared during the year upon the subject of postoperative parotitis. According to Deaver,⁷⁰ the pathology is due to one of three causes: (1) The lesion is a metastatic focus during an established pyemia; (2) the process results from an infection which ascends in Stenson's duct; or (3) it results from some trauma, such as the forcible pressure exerted by an anesthetist while pulling the jaw forward during a narcosis. The second of these mechanisms is by far the most frequent. Postoperative parotitis follows in about 0.1 per cent. of the cases (Collins⁷¹) and is more apt to occur after abdominal operations for infective conditions. Its development is favored by a dry mouth condition and by a lack of fluids in the body. In patients whose abdominal condition makes it necessary to withhold all food and drink for a time, prophylactic treatment is advisable; the mouth should be kept clean and moist and the body should be supplied abundantly with water. Sucking a stick of lemon candy invites an abundant flow through Stenson's duct; and an accurate way to administer fluids is by hypodermoclysis.

Surgery in Syphilitic Patients. Opinion seems to be divided, some surgeons maintaining that syphilis does not retard in any way the healing of wounds, but de Mendoca's⁷² experience has convinced him that lues, as well as other constitutional diseases, is able and liable to exert a most unfavorable influence on the healing of wounds, both in the trunk and on the extremities, as well as on the postoperative course. In 3 of his patients the laparotomy wound reopened, or there was dilatation of the stomach; in these, the Wassermann reaction was strongly positive, and under specific treatment, healing proceeded without further mishap. Other instances are reported of complications in the skin, etc., developing

⁷⁰ *Annals of Surgery*, 1919, lxi, 128.

⁷¹ *Surgery, Gynecology and Obstetrics*, 1919, xxvii, 404.

⁷² *Medico*, Rio de Janeiro, 1918, xxxii, 361; Abstract, Journal of the American Medical Association.

after operation on syphilitic subjects, all emphasizing the wisdom of a course of specific treatment before attempting any operation on such patients.

Biological Test for Active Tuberculosis. Wildbolz⁷³ reports that his researches and experiences with more than 200 persons, during the last year and a half, have demonstrated that when there is an active process of tuberculosis, the urine contains an antigen, which, when injected by the Mantoux intradermal method, induces redness and infiltration. This does not occur with the urine of healthy persons, or in urine from persons with a healed tuberculosis. The reaction never occurs unless the person tested gives a response to a 1 to 10,000 tuberculin injection; and it seems to occur whether the urine is from the person tested, or not, as long as he has an active focus anywhere in the body—glands, peritoneum, lungs, bones, or anywhere else. Wildbolz evaporates morning urine to 1 to 10, passes the residue through a filter impregnated with 2 per cent. phenol, and then makes three sets of two injections in the skin of the arm. The two upper are made with 1/1000 tuberculin; 3 or 4 cm. below the first, two with 1/10,000 tuberculin; and at a similar distance apart, two with a minute amount of 1/10 evaporated urine. The response in a person with an active tuberculous process is the same with the urine as with diluted tuberculin; but the tuberculin response persists unmodified after the tuberculous process heals while the urine response fades out completely. A similar response was never obtained in the non-tuberculous, in syphilis, influenza, etc., with the single exception that urine containing large amounts of staphylococci induced a reaction. With this exception the findings may be depended upon, according to Wildbolz, to reveal the tuberculous, or non-tuberculous, nature of any lesion and to disclose when the former are healed. If the urine reaction persists after the apparent clinical healing of the known focus, one can be sure that another focus exists somewhere in the body.

The specific nature of the urine reaction can be demonstrated more conclusively by the fact that after subsidence of the reaction, the injection of 1 to 1000 tuberculin, made nearby, causes the apparently extinct urine reaction to flare up. This does not, however, always occur, but it is frequent enough to testify to the specific action of the urine reaction. By comparing the urine with the tuberculin reaction, one can obtain better insight into the process of cure and whether treatment must be kept up. In those being treated with tuberculin, misleading findings may be obtained because of the excretion into the urine of the tuberculin.

Lewis⁷⁴ reports the results of studies aimed primarily to determine, if possible, the lack of harmony that characterized the experience of different workers in the application of the complement-fixation test for tuberculosis. His most important practical conclusion is that the numerical relations are such as to make it unsafe to apply the reaction to the diagnosis of tuberculosis, except as a matter of most limited confirmatory interest. This opinion seems to be becoming general.

⁷³ *Correspondenz-Blatt für Schweizer Aerzte*, 1919, xlix, 793.

⁷⁴ *American Review of Tuberculosis*, 1919, iii, 129.

SURGERY OF THE ABDOMINAL PARIETES.

Transthoracic Laparotomy. The war experience has opened up an extensive new field for transthoracic laparotomies in cases of injury. It has been found best to attend first to the damage wrought in the chest, and then to try to reach and deal with the injured abdominal organs either by deliberately incising the diaphragm, or by enlarging any wound in it. Sauerbruch reports three successful operations in all of which a differential air-pressure apparatus was employed. He lays stress on the importance of incising the diaphragm transversely, or obliquely to the direction of the fibers, and not parallel, in order to avoid injury to the phrenic nerve. From his own experience and from that recorded in the literature, Willy Meyer⁷⁶ believes that the question of whether operation is to be done immediately after the accident, or later, depends on the seriousness of the concomitant symptoms; simultaneous injuries to chest and abdomen, as well as injuries of the liver or the spleen, without previous penetration of the chest, render the indication for transthoracic laparotomy when they are not accessible from below. Involvement of intra-abdominal organs can be determined before, or during, a thoracotomy. Meyer believes that such operations are best done with the help of some differential air-pressure apparatus; opinion in America will, probably, not coincide generally with this and practice will make use more frequently of the various methods of intratracheal, or intrapharyngeal, anesthesia.

Laparoplasty. A new method of laparoplasty is proposed and described by Van Hook:⁷⁶ The operation is to be done for relaxed, pouching or pendulous abdomens. A subumbilical median incision is made; any hernial sac is dealt with up to the point of closing the peritoneum. Thereafter transverse incisions are added at right angles, from a point one or two inches above the symphysis pubis, extending outward for six or more inches, and turning upward and outward in the direction of the fibers of the external oblique aponeurosis and muscle at the outer border of the rectus abdominis muscle. Triangular flaps are thus made including the anterior sheaths of the recti and continuous with the external oblique muscles. These are crossed and reattached to the external oblique aponeurosis, to Poupart's ligament, and the anterior sheath of the rectus at points farther forward, the one flap lying under the other. The skin incision is then closed. In two personal cases Van Hook obtained good results.

Peritonitis. HEMATOGENOUS STREPTOCOCCUS PERITONITIS is rather uncommon and the report of Rabinowitz⁷⁷ concerns itself with 8 personally treated cases. Seven of these occurred in female patients from ten months to twenty-one years of age. All occurred during the winter and spring, corresponding to the prevalence of sore-throat. The history usually was that, while apparently in the best of health, the patient

⁷⁶ Transactions of American Surgical Association, 1919.

⁷⁶ Surgery, Gynecology and Obstetrics, 1919, xxviii, 598.

⁷⁷ American Journal of Medical Sciences, 1919, clvii, 797.

had sickened, with high fever (105° F.), severe generalized abdominal pain, repeated vomiting, and marked prostration. These phenomena persisted. Following a distinct sore-throat, there may be a free interval of several days. The temperature remains high, the pulse is rapid and out of proportion to the fever. Herpes was always absent. Diarrhea occurred in a few of the patients. The leukocyte count was comparatively high—from 25,000 to 64,000; polymorphonuclear counts averaged 92 per cent. The abdomen was tender and moderately rigid all over. There was no marked distention and not commonly was the presence of fluid to be made out. Death occurred in from three to eight days with the signs of marked toxemia.

In discussing PERITONITIS RESULTING FROM PERFORATION OF ABDOMINAL VISCERA, Mayo⁷⁸ said that a considerable percentage of free abdominal perforations are spontaneously closed and that the area of peritonitis is limited through natural processes. The death-rate is, possibly about 30 per cent.; but 70 per cent. who recover spontaneously from the attack are not cured. Chronic conditions usually precede the perforation and give ample warning. Early operation—that is within the first eight hours, barring accident, means recovery because the stage of contamination has not yet passed into that of infectiousness; measures may still be taken for the permanent cure of conditions which lead to the perforation.

A very uncommon accident—perforation following a cicatricial stenosis of the jejunum—was reported by Lazarevic.⁷⁹

The ROUTINE "ANOCIATED" TREATMENT OF ABDOMINAL INFECTION (PERITONITIS), as used by Crile⁸⁰ and his associates, includes the following:

1. Nitrous oxide anesthesia.
2. Anesthetized incision.
3. Accurate clean-cut operation to diminish both infection and shock.
4. Adequate drainage.
5. Fowler's position.
6. Vast hot packs over the entire abdomen, spreading well down on the sides.
7. Five per cent. sodium bicarbonate, with 5 per cent. glucose by rectal infusion, continued as long as it is tolerated.
8. Primary lavage of the stomach repeated if indicated. (It will rarely be indicated if anociation is complete.)
9. From 2500 to 3000 c.c. of physiologic salt solution administered subcutaneously every twenty-four hours until the period of danger is past.
10. Morphine hypodermically until the respiratory rate is reduced to from 10 to 14 per minute and held until the danger is past. It should be noted, however, that morphine is not useful in a *Streptococcus* peritonitis.

The prime requisites which Crile aims at are (1) the conservation of

⁷⁸ Surgery, Gynecology and Obstetrics, 1919, xxviii, 29.

⁷⁹ Deutsche Medizinische Wochenschrift, 1919, xlv, 123.

⁸⁰ Journal of the American Medical Association, 1919, lxxiii, 1655.

the remaining energy of the body against further depletion and (2) the neutralization and elimination of the superabundant waste products.

In a number of cases Allegra⁸¹ found it simple and effectual to establish *drainage of the iliac fossæ* through the ileopectineal space. The iliac fascia is incised and the psoasiliacus muscles are pushed to one side; a button-hole in the peritoneum is then all that is necessary; the drainage is at the most dependant point.

Heald⁸² uses a *double caliber glass tube with a removable gauze wick*. The double tube is one-half inch in diameter. The lower end is closed except for an oval opening one-eighth inch from the bottom. A longitudinal septum divides the lumen into two parts to within one-fourth inch from the lower end. One end of a gauze wick, one inch wide and several yards long, is inserted in the upper end of one barrel and is pushed down its lumen with a small probe, pulled out of the opening in the bottom, reinserted through this opening and pushed up through the other barrel, passing around the smooth lower end of the septum. The tube threaded with its wick is inserted to the bottom of the cavity to be drained and the outer wound is closed completely around it. The tube should be long enough to project above the dressings and it is covered by a sterile towel; these are protected by a sheet of rubber dam through a small stretched opening of which the tube passes. The roll of sterile gauze wick in a cloth bag is pinned outside of the dressing and is also covered with a sterile towel. During the first twenty-four hours, at more or less frequent intervals, depending on the quantity of purulent secretion, the nurse, with sterile gloved hands, pulls the wick through, while steadying the tube with one hand, until the wick comes through dry, cuts off and removes the soiled portion, and replaces the sterile towel—all without having disturbed the patient. After twenty-four hours the tube, having served its purpose, is removed and replaced by any kind of a drain the surgeon prefers. The method is used in the drainage of any dependant cavity.

Tagliavacche⁸³ has a *button cannula for the continuous drainage of ascites*. It is a broad tube bent at a right angle, with wide openings at the tip. This tip is introduced into the abdominal cavity while the flat, flaring mouth of the tube, which is fitted into the subcutaneous space, keeps it in place and prevents it from slipping into the abdomen. In the case for which the button was made, it rested on the aponeurosis, and the fluid drained best when the patient lay on her side. The woman died five months later but during that time her condition was a much more comfortable one. The cannula was well borne.

Konig⁸⁴ adds 3 cases of BILE PERITONITIS to the previous ones on record. The bile was evidently derived by diapedesis. One patient had previously had an adenocarcinoma of the gall-bladder which had

⁸¹ Policlinico, Rome; Abstract, Journal of the American Medical Association, 1918, lxx, 659.

⁸² Surgery, Gynecology and Obstetrics, 1919, xxvii, 326.

⁸³ Prensa Medica Argentina, Buenos Aires, 1918, v, 172; Abstract, Journal of the American Medical Association.

⁸⁴ Deutsche Medizinische Wochenschrift, 1919, xlv, 121.

been removed. In the other two, there was a chronic cholecystitis with stones.

Devincenzi⁸⁵ reports that in the last *typhoid* epidemic at Montevideo, *perforation* occurred in 14.4 per cent. of 84 cases; this is very high. In 23,113 cases, collected from international sources, the range was from 1.75 to 6.54 per cent., with an average of 3.73 per cent. The percentage is for male patients; in women the frequency is much less, there being only 3.33 per cent. among 60 women. With prompt operation, 27 per cent. recovered in the cases which Devincenzi has compiled.

Cordier⁸⁶ attempts to establish a direct *action of the malarial parasite on serous membranes* in general. In one of the groups described there is a peritoneal reaction: meteorism, hiccough, vomiting and symptoms referable to, and suggesting trouble in the spleen or gall-bladder. No effusion occurs.

Morquio⁸⁷ describes a form of PLASTIC PERITONITIS which he has seen in children. The lesions consisted of areas of induration in the peritoneum—actual peritoneal plastrons; these caused symptoms for a time but finally resorbed of themselves. The children were from three to thirteen years old. The duration of the illness averaged about three months. The onset was sudden, as with any acute peritonitis of appendicular, pneumococcic, or gonococcic origin. This was followed by a slow remittent course; suppuration was feared at times and Morquio was on the point of operating several times, when all the manifestations subsided spontaneously. The symptomatology differed according as the circumscribed lesion was located in the pelvis, the epigastrium, the kidney region, or elsewhere. The tuberculin test was negative. In some, an appendicitis seemed to be responsible, and a small abscess in 2 cases was opened and drained; but in another patient an interval appendicectomy showed a normal appendix. One of the children had a vulvovaginitis and the peritoneal plastrons were evidently the work of the gonococcus.

Castex⁸⁸ reports several cases of GUMMATOUS PELVIC CELLULITIS, the symptoms of which comprised various intestinal disturbances extending over a period of several months combined with a considerable loss of weight. A large tumor could be palpated filling the pelvis, but apparently not encroaching on the peritoneal cavity. Signs of inherited syphilis were pronounced in one of the patients; in another this differentiation was not possible. The remarkably good general condition suggested the possibility of gummatous cellulitis instead of a malignant tumor and under intensive treatment the whole clinical picture subsided in several months. The infiltration in the cavity of Luschka readily explained the bladder symptoms, and those referable to the rectum and prostate. The treatment had to be intensive and prolonged to secure a cure. Castex knows of only one similar case on record, that reported by Fournier in

⁸⁵ *Anales de la Facultad de Medicina, Montevideo, 1919, iv, 214; Abstract, Journal of the American Medical Association.*

⁸⁶ *Annales de Médecine, Paris, 1919, vi, 89.*

⁸⁷ *Bulletin de la Société Médicale des Hôpitaux, Paris, 1919, xliii, 406.*

⁸⁸ *Prensa Medica Argentina, 1919, v, 248; Abstract, Journal of the American Medical Association.*

1912—in which a cellulitis had resulted from inherited syphilis in a man, aged thirty-four years.

Blanc Fortacin⁸⁹ describes a METHOD FOR THE PROMPT AND DURABLE RELIEF OF UNBEARABLE NEURALGIC PAINS ACCOMPANYING EXTENSIVE PELVIC CARCINOSIS. This consists of the intrapinal injection of 2 c.c. of a 10 per cent. solution of quinine and urea hydrochloride. The relief of pain was so great, that in a patient who had been accustomed to the repeated exhibition of morphine, none of the latter drug was required for twelve days following the spinal injection. The intraspinal injection induced a transient febrile reaction, with headache and vomiting, but there were no motor or vasomotor by-effects.

SURGERY OF THE ABDOMINAL VISCERA.

Ligation of the Hypogastric Artery. Pou Orfila⁹⁰ has tied the hypogastric artery in three cases. The ligation was done in one case for an arteriovenous aneurysm of the hypogastric artery and vein in a woman of thirty-two years; in another case to arrest secondary hemorrhage after colpotomy in a younger woman with a bad post-abortion infection; in the third case the ligation was done for secondary hemorrhage after spontaneous rupture of the uterus and bladder in labor. Unilateral enlargement of the buttocks and pudenda is an important sign with arteriovenous aneurysm; a thrill in the vaginal cul-de-sac may be due to other causes.

The intraperitoneal route is preferable in the obese. Ordinarily, it is easy to reach the artery through an incision in the flank by taking advantage of the cleavage planes. This technic is particularly useful when there are infectious processes in the pelvic cellular tissues. Pou Orfila advises ligating with catgut in cases of hemorrhage and with silk for an aneurysm.

Ligation of the Inferior Vena Cava. Nobel⁹¹ removed a tumor lying across the lumbar vertebræ and behind the peritoneum; during the manipulations the vena cava was torn obliquely. A suture not being possible, the vein was ligated above and below with plain catgut; the peritoneum was then sutured over the vessel and the abdomen closed without drainage. The patient, a woman of sixty-two years, made an uninterrupted recovery without swelling or edema of the legs, or any other untoward symptom; the recovery was permanent.

Postoperative Obliteration of the Mesenteric Vessels. Up to 1913, Escudero⁹² has found records of 360 cases of postoperative obliteration (thrombosis) of the mesenteric vessels. The correct diagnosis was made in only 13 of the total 360 cases. The preëxisting condition of the vessels must be so pathologic that even the slightest superimposed

⁸⁹ *Revista de Medicina y Cirugía Practicas*, Madrid, 1919, cxxii, 70; Abstract, *Journal of the American Medical Association*.

⁹⁰ *Anales de la Facultad de Medicina*, Montevideo, 1919, iv, 336.

⁹¹ *American Journal of Obstetrics and Diseases of Women and Children*, 1919, lxxviii, 851.

⁹² *Revista de la Asoc. Med. Argentina*, 1918, xxix, 625; Abstract, *Journal of the American Medical Association*.

element is sufficient to induce thrombosis. The clinical picture may include pain—rebellious to morphine—tympanites, and profuse gastric hemorrhage. Another laparotomy is the only hope, this only when done in time and when the lesions are not irreparable.

Septic Phlebitis. Inigo⁸³ describes a number of cases in which a rise of temperature and an acceleration of the pulse were the only signs of an insidious septic phlebitis. The fever was not high but occurred spasmodically and was of brief duration; it was usually preceded by a chill, or, at least, by chilliness and a feeling of malaise: Nothing was present in the wound to account for the temperature. Necropsy in some of the cases cleared up the diagnosis for the first time. Septic phlebitis was responsible for 66 per cent. of the mortality of war wounds of the chest, according to Borrows,⁸⁴ and in an even larger proportion in limb wounds.

Disturbances of the Solar Plexus. Dré Kolias⁸⁵ ascribes to *irritation of the solar plexus* a number of disturbances of the pneumogastric-sympathetic system, including hiccough, abdominal painful points, reflex disturbances in the throat, sweat glands, heart and pupils, as well as certain functional brain and spinal cord disturbances. He describes in detail a young woman who had been having stomach pain for three years; the latter were girdle pains; in addition there were various tender abdominal points, pains in the temples and back of the neck, and occasional loss of consciousness and vomiting. She was sent to the hospital with the diagnosis of "repeated hematemesis with hysteria." Convinced that the solar plexus was the responsible cause for the larger part of the symptoms, Dré Kolias operated, opened up the solar plexus and dissected around the tripod, formed by the celiac trunk, to break the filaments of the solar plexus and detach the semilunar ganglia. The operation relieved the woman of all of the symptoms and when last seen nine months afterwards, she was in florid health. Jaboulay⁸⁶ published a similar case treated in the same manner by what he called "*elongation du plexus solaire*." Dré Kolias calls the clinical picture "*cyclone du plexus solaire*" and believes that his success justifies wider application of operative relief for functional disorder of the solar plexus.

Two cases are cited by Meyerson,⁸⁷ in insane patients, in whom acute intestinal conditions were associated with changes of the nerve cells of the solar plexus of the type described as acute Nissl degeneration. One of the patients was a dementia precox subject of middle age; the other was a juvenile paretic dying of pleurisy with effusion of tubercular origin, with fecal impaction and congestion of the peritoneum; in both, these changes were found without any corresponding changes elsewhere. The value of these observations is problematical.

⁸³ *Revista Espanola de Cirugia*, Madrid, 1919, i, 143; Abstract, *Journal of the American Medical Association*.

⁸⁴ Quoted by Inigo.

⁸⁵ *Grèce Médicale*, Athens, 1919, xxi, 17; Abstract, *Journal of the American Medical Association*.

⁸⁶ Quoted by Dré Kolias.

⁸⁷ *Boston Medical and Surgical Journal*, 1919, clxxx, 208.

The Omentum. Finton and Peet⁹⁸ made an experimental study of *the use of detached omental grafts* in intestinal surgery. Detached grafts are better, except in the presence of infection, and may be used on any organ. The indications for their use are: (1) To replace lost portions of peritoneum; (2) to strengthen suture lines; (3) to prevent adhesions; (4) to check hemorrhage; (5) to occlude the pylorus; (6) to cover the stump of the cystic duct or Fallopian tube; and (7) to reinforce the peritoneum in a threatened perforation. In the absence of any infection, the grafts survive for a period of approximately six months practically unchanged.

Miginiac⁹⁹ remarks that the only treatment for *traumatic retroperitoneal hematomas* is by a laparotomy. In 45 cases, which he had compiled, the mortality in all the untreated cases was 100 per cent.; only 2 recovered in the 6 cases treated by puncture alone. These are very serious lesions, the symptomatology is very acute and very fulminant and frequently resembles that of a perforation of the intestine.

A very curious surgical emergency is *torsion of the great omentum*. The mechanism usually includes fixation of the lowermost end of the omentum, most often in an inguinal ring or hernial sac. In a number of cases, observed by Bubis,¹⁰⁰ the emergency occurred during pregnancy and in these Bubis believes that fixation of the tip occurred in the cul-de-sac. The pressure of the growing uterus, the peristaltic action of the intestines, together with the congestion of the omental veins, were, undoubtedly, secondary causes of the condition. A localized point of tenderness, normal temperature, pulse and respiration, and the absence of nausea and vomiting in the early stages of pregnancy are pointed out as constituting a group of symptoms very suggestive of omental torsion. One hundred and thirteen similar cases are on record.

Hunt¹⁰¹ adds 11 cases of *torsion of the appendices epiploica* to those already reported in the literature. Seven of these are true torsions; one, a doubtful torsion (the mechanism was that of a band producing an obstruction); two were incarcerations in a left inguinal hernia; and one a foreign body with an unproved origin from an appendix epiploica. Four of the cases represented acute symptoms, for which operation was done, and in the remaining cases the torsion was probably symptomless as it was found during the course of abdominal operations for other pathological conditions. The cases with incarceration presented the symptoms usual with the latter condition.

Mesenteric Lymph Nodes. The clinical picture of *perforation of tuberculous mesenteric lymph glands* simulates accurately that of appendicitis. The condition occurs most usually in children or in young women. According to Iselin,¹⁰² all recover. Mixed infections may occur. The x-ray hastens the softening of the suppurating glands. In one of Iselin's cases x-ray treatment of a tuberculous peritonitis was followed by perforation of the bowel.

⁹⁸ Surgery, Gynecology and Obstetrics, 1919, xxix, 281.

⁹⁹ Revue de Chirurgie, 1919, xxxviii, 81.

¹⁰⁰ Surgery, Gynecology and Obstetrics, 1919, xxviii, 33.

¹⁰¹ Annals of Surgery, 1919, lxix, 31.

¹⁰² Correspondenz-Blatt für Schweizer Aerzte, 1918, xlviii, 1569.

Such adenopathies are rather frequent in the angle of junction of the small and large bowel and, being frequently mistaken for appendicular conditions, are subjected to operation. The opening of the glandular abscess, or the removal of the offending gland, is frequently accompanied by some compromization of the blood supply; in others the simultaneous removal of the appendix results in a suture line which the tuberculous nature of the accompanying lesion renders insecure; in either case the healing of the wound is commonly interrupted by a fecal fistula the unhealability of which makes necessary subsequent secondary operations usually taking the form of ileocecal resections.

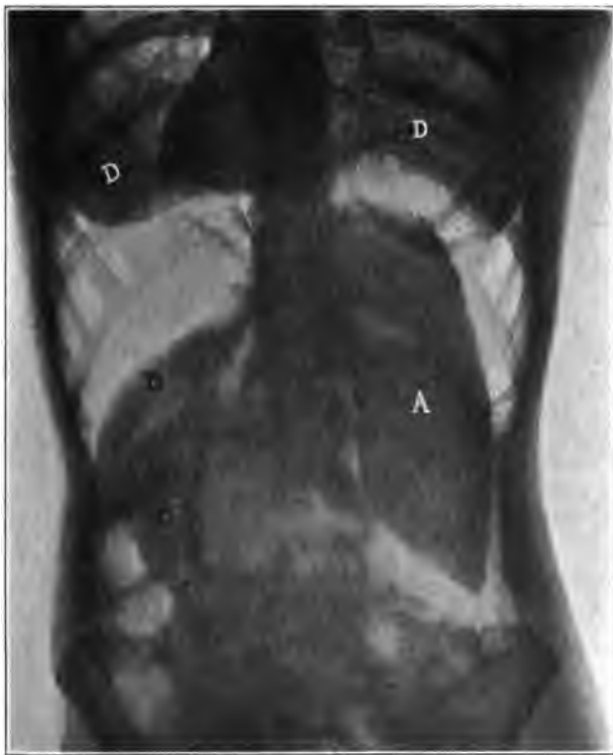


FIG. 31.—Patient in erect position. A, liver; B, spleen; C, right kidney; D, diaphragm.

Roentgen Examination of the Abdominal Organs Following Inflation of the Peritoneal Cavity. Stein and Stewart¹⁰⁸ review the history of this procedure and give the results of their own studies. "The introduction of air, or gas, as an adjuvant of roentgenology is not . . . entirely new, for the procedure has been repeatedly employed in the past as a diagnostic aid. . . . Credit for the original idea of air inflation of the peritoneal cavity for diagnostic purposes must be given to Kelling, who, in 1902, employed this method of inspecting the abdominal con-

¹⁰⁸ *Annals of Surgery*, July, 1919, p. 95.

tents of two human beings. . . ." Following Kelling, work was done by Jacobaeus of Stockholm in 1910 and 1911, by Weber in 1912, by Lorey in 1912, by Rautenberg in 1914, by Meyer-Betz in 1914, by Goetze in 1918, by LePage and by Bécélère. Weber's studies in 1912 showed that the following viscera and areas could be rendered visible by gas inflation of the peritoneal cavity: (1) The liver and spleen, as a whole, and including the gall-bladder; (2) coils of intestine without any contrast-substance contents; (3) the pyloric portion of the stomach; (4) the bladder filled with urine; (5) parts of the mesentery; (6) the subphrenic space; (7) intraabdominal tumors.



FIG. 32.—A, kidney; B, spleen; C, oxygen.

The method employed by Stein and Stewart is as follows: "After the patient is prepared in the usual manner for Roentgen examination. . . . he is put flat upon his back and the abdomen is then inflated with about 3 or 4 liters of oxygen. The whole outfit required for this procedure consists of an oxygen tank to which is attached a rubber bag (such as is used with the gas-oxygen apparatus for anesthesia) with a capacity of about one gallon or 4 liters. To this bag is attached a small rubber tube which can be easily connected with a regular lumbar puncture needle. The spot where the needle is to be inserted is sterilized with iodine and the skin rendered insensate by an injection of novocain-adrenalin solution. The spot from which in our judgment it is easiest to inflate the abdomen, is two to three fingers to the left of the umbilicus and about one and a half inches below it. This procedure is very simple.

Anyone, who has had surgical experience, can easily gauge the thickness of the abdominal wall. Our practice is to push the needle to a point where it touches the fascia; then we stop for one or two seconds. After that, the needle is pushed through the fascia, muscle and peritoneum

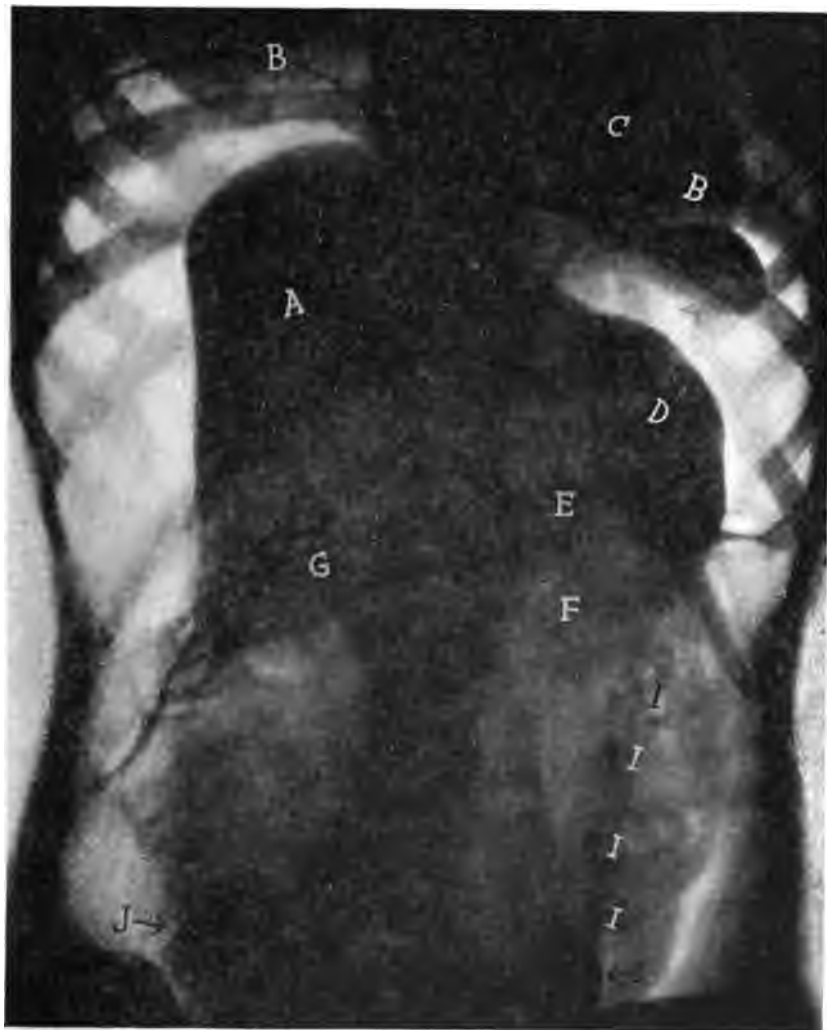


FIG. 33.—*A*, liver; *B*, diaphragm; *C*, heart; *D*, spleen; *E*, pedicle of spleen; *F*, left kidney; *G*, right kidney; *H*, four enlarged mesenteric glands; *I*, enlarged cystic ovary; *J*, mass involving right tube and ovary.

without any difficulty. The plug is then removed from the needle and the needle is connected with the rubber bag. A slight pressure on the bag will now inflate the abdomen with oxygen. As a rule, this takes between four and five minutes and the amount of oxygen to be introduced varies between 3 and 4 liters or one gallon. When the abdomen

is entirely distended, the patient usually complains of a sensation of fullness and slight pains in the shoulders (the latter apparently due to pressure against the diaphragm)." Two or three hours later the patient is x-rayed. The oxygen is usually absorbed without any trouble within twenty-four hours.



FIG. 34.—A, myoma uteri; B, stretched round ligaments; C, pedunculated fibroid.

Stein and Steward were able to demonstrate the outlines of the organs, very marked adhesions, and a large carcinoma of the ascending colon, as well as the pelvic organs. "Pathological conditions, such as carcinomatosis, cirrhosis or marked hypertrophy of the liver, enlargement of the spleen and tumors of the stomach and intestines, as well as those of the genital organs, are now easily demonstrated." The accompanying illustrations are very illuminating.

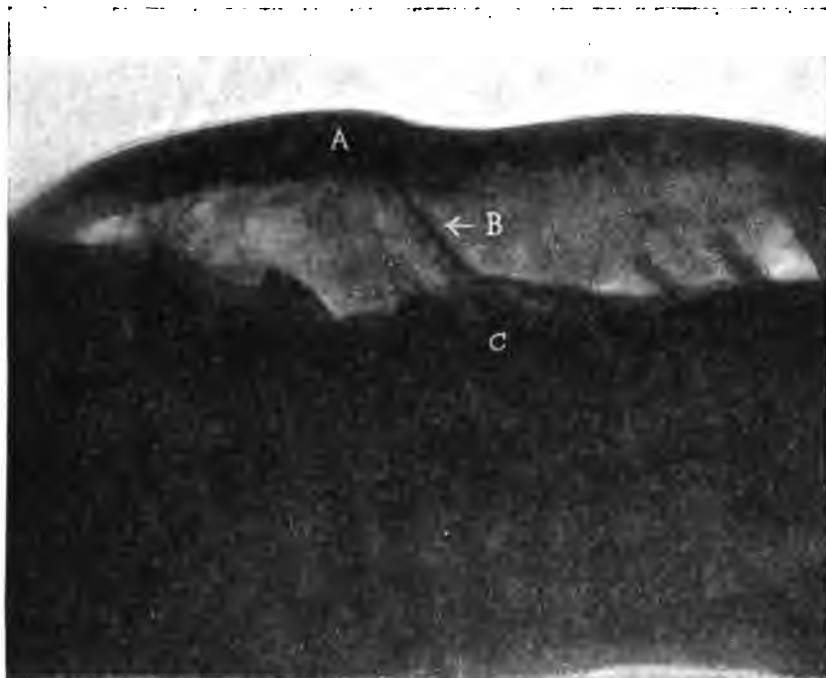


FIG. 35.—*A*, abdominal wall; *B*, intraperitoneal adhesions; *C*, coils of intestines.



FIG. 36.—*A*, enlarged right kidney; *B*, liver; *C*, adhesions; *D*, bladder distended with air.

From personal observation, Dandy¹⁰⁴ is convinced that perforation of the intestines, or stomach, can be demonstrated by the x-ray. The escaping gas accumulates under the diaphragm, if the head be elevated, and roentgenograms show the diaphragm and liver sharply outlined with collections of gas separating the structures. Localized collections of gas in the abdominal wall, the buttocks, etc., when visible, may betray a colon infection. Dandy made no intraperitoneal injections with air, but believes the procedure to be safe and capable of offering valuable information.

Esophagus Grafted with Segment of Intestine. Razzaboni¹⁰⁵ has had complete success with some of his operations on dogs in which he implanted into a gap in the esophagus a segment of intestine taken from the same, or another dog, or from a cat. Each method proved a success in some, and failed in other cases. It was found, however, that the implanted segment shriveled and retracted so that a graft 4 or 5 cm. long became reduced to 1 or 2 cm.; stenosis of more or less degree resulted. The latter was most pronounced with the heteroplastic transplants. The intestinal tissue became transformed so that not a trace of bowel tissue was apparent when the animals were killed. The experiments demonstrate beyond question, according to Razzaboni, that extensive loss of substance of the esophagus can be repaired with a free graft from the large, or small, intestine.

THE STOMACH.

Treatment of Cardiospasm. It seems plausible, from the experience which Benjamins¹⁰⁶ reports, that a different mechanism may be responsible for the cardiospasm in different cases. Usually the spasm is in the lowest segment of the esophagus and not in the cardia itself. In 5 of Benjamin's patients the retention caused great distention of the esophagus, and in 2 others cicatricial degeneration had actually closed the lumen. Radioscopy with the contrast meal and with a small metal sound usually furnishes much information; esophagoscopy is conclusive. Guisez had 15 cases of cardiospasm in persons from sixty to eighty-nine years of age; and 2 of Benjamins' patients were men of fifty-four and sixty-four years. General measures to reduce the tendency to spasm should be supplemented by systematic dilatation under esophagoscopic control. If this has been given a thorough trial and has failed, an operation should be recommended.

A new, and very simple, operative procedure was suggested by Heller¹⁰⁷ in 1913: It consists of applying the principle of the Rammstedt operation for pyloric stenosis to the cardiac orifice; good results are reported.

Cardiospasm is sometimes secondary to cancer in the upper portion

¹⁰⁴ *Annals of Surgery*, 1919, lxx, 378.

¹⁰⁵ *Policlinico*, Rome, 1919, xxvi, 1; Abstract, *Journal of the American Medical Association*.

¹⁰⁶ *Nederlandsch Tijdschrift v. Geneeskunde*, Amsterdam, 1919, ii, 159; Abstract, *Journal of the American Medical Association*.

¹⁰⁷ *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1913, xxvii, 141.

of the stomach. Spasms elsewhere in the body may accompany the cardiospasm.

Dilatation of the Stomach. The mechanism of an acute dilatation of the stomach is still to be explained. Barber¹⁰⁸ points out that atmospheric air serves as a basis for stomach gas. The intragastric content of air tends to preserve the normal intragastric tension at which the stomach contracts most effectively; above and below this point the vigor of the contractions lessen. Spontaneous rupture of a normal stomach is probably unknown. In dilated stomachs the gas accumulates in abnormal amounts and correspondingly influences gastric peristalsis.

There is in both stomach and duodenum an intrinsic nervous system which, for the sake of simplicity, Harrigan¹⁰⁹ calls the myenteric plexus. In various places it is so arranged as to form distinct nodes. This nodal system comprises, supposedly, the points from which peristalsis is initiated. At present there is no direct evidence to prove that marked alterations occur in the myenteric plexus as a result of, or coincident with, duodenal obstruction and dilatation of the stomach. In all of these investigations a marked disadvantage lies in the absence of technical methods which can actually reproduce acute dilatation of the stomach. Moreover, the animals best suited for these experiments, such as the dog and cat, offer peculiar difficulties to the histologist, and from the standpoint of the latter the white rat is perhaps the best. The finding of anatomical alterations in the myenteric plexus would prove of value to constitute direct proof that the theories of Keith, regarding the nodal system, possessed a sound basis. This more recent knowledge of the stomach and duodenum should be taken into consideration in the study of the causation of acute dilatation of the stomach.

A chronically dilated stomach is a type which "Hayem¹¹⁰ describes as "dilatation par trouble digestif"; here the evacuation of the organ is unduly prolonged and laps over into the next meal. The stomach does not empty itself completely between meals and so never gets a chance to rest and becomes liable to dilatation from overwork. In addition, there is usually a tendency to hypersecretion and hyperchlorhydria. Treatment with alkaline saline waters generally corrects the condition provided the stomach is allowed to rest. This can be realized by making the intervals between meals longer and by reclining an hour before meals with a cushion under the seat to give the stomach a chance to empty itself completely under the influence of gravity. The general rule is to lie down after meals but for this purpose it is to be done before eating. Light massage of the stomach, while reclining, may prove useful. Hayem allows only two meals a day with an interval of about nine hours. A little weight is lost at first but gradually the whole condition improves; the stomach returns to its normal size, and weight is regained.

Phlegmonous Gastritis. Sundberg¹¹¹ gives the details of 17 cases of phlegmonous gastritis from the clinics of Stockholm and Upsala, and

¹⁰⁸ *Annals of Surgery*, 1919, lxi, 277.

¹⁰⁹ *Ibid.*, p. 510.

¹¹⁰ *Bull. de l'Académie de Méd.*, Paris, 1919, lxxxi, 178.

¹¹¹ *Nordiskt Medicinskt Arkiv*, Stockholm, 1919, li, 303. Abstract, *Journal of the American Medical Association*.

tabulates with these 215 others collected from the literature. Cases in men are nearly three times more numerous than in women and the ages run between twenty and sixty. Twenty-five per cent. were hard drinkers. High fever and general malaise, headache and thirst, with vomiting and sometimes violent and persistent hiccough often usher in the illness. Streptococci have been demonstrated in 71 of the 95 cases which were examined. In the personally observed cases there was always a history of a preceding gastritis, and the secretion of gastric juice was abnormally low. The inflammatory process develops in the submucosa. The inflamed mucosa is peculiarly vulnerable and the deficient acid leaves it defenceless. Infection can occur by direct implantation of the germs, or by way of the blood. Pus in the vomit is the most instructive sign of the affection especially when the amount is large and the intervals short. The pain seems to subside on sitting up. In 33 per cent. of the fatal cases there was no indication of peritonitis. Rational treatment is only feasible in the localized form of the disease and can only be by resection of the affected portion; spontaneous cures are known. The death-rate in the non-operative cases is 92 per cent. Novak reported one case this year which recovered after a partial gastrectomy.

Intussusception of the Stomach. Möller¹¹² gives an illustrated description of the findings at necropsy of a woman of sixty-six years with an acute stenosis of the pylorus from intussusception of the body of the stomach into the pyloric region; the lesion was brought about by the incarceration in the duodenum of a large pedunculated papilloma of the stomach. The neoplasm had probably existed for years but had caused no symptoms until a short time before death. Möller has been able to find only two analogous cases in the literature. All of the patients were elderly women with pedunculated tumors of the stomach which had caused no symptoms until the tumors had slipped into the duodenum. Signs of stenosis of the pylorus are the first to attract attention. Blood in the stools and jaundice may be observed, but the prognosis depends on the promptness of operative relief. Möller refers to a case of Ederlein in which invagination occurred into a much dilated esophagus.

Polyposis of the Stomach. The accompanying illustrations taken from Balfour's¹¹³ paper show how very characteristic the roentgenographic pictures of this condition can be.

Myoma of the Stomach. Among 140 myomatous gastric tumors on record, Nasseti¹¹⁴ found that 58 were simple myomas, 37 were fibromyomas, 6 were adenomyomas and one was a myxomyoma. All the others were of mixed sarcomatous nature except 9 listed as "malignant myoma." In 40 operated cases recorded in the literature, the tumor was in the submucosa in 8 and in the subserosa in the others. Operative treatment is the only rational measure. Pneumonia and embolism were responsible for at least 4 of the 10 fatalities.

¹¹² Hospitalstidende, Copenhagen, 1918, lxi, 1592; Abstract, Journal American Medical Association.

¹¹³ Surgery, Gynecology and Obstetrics, 1919, xxviii, 465.

¹¹⁴ Tumori, Rome, 1918, vi, 172; Abstract, Journal of the American Medical Association.

Congenital Pyloric Stenosis. Pirie¹¹⁵ suggests that the spasm producing hypertrophy of the pylorus is, primarily, due to hyperadrenalism before birth and that other subsidiary postnatal causes determine the persistence of the spasm, or its recurrence. The condition of hyperadrenalism may be relative, or absolute, and is due to a lack of balance between the



FIG. 37 (250518).—The mottled appearance (dark areas) in the roentgenogram are shadows due to the polypi in the stomach. See specimen, Fig. 38. (Balfour.)



FIG. 38.—Photograph of specimen. (Balfour).

secretions of the various endocrine organs in the process of normal involution. On clinical grounds the amount of hypertrophy present at birth is apparently insufficient, except in rare instances, to cause immediate symptoms of obstruction. Other conditions may, however, become operative which will cause spasm of the pylorus after birth sufficient to

¹¹⁵ Lancet, London, 1919, ii, 515.

complete the obstruction in an already stenosed orifice. That some of these patients recover without surgical intervention is due to the fact that the subsidiary conditions are amenable to palliative treatment and are of greater moment in producing the obstruction by added spasm than the congenital stenosis itself. The effect of the stenosed pylorus on the walls of the stomach itself is to produce swelling of the mucosa. In many of the cases, perhaps all, there are changes produced by undue retention and fermentation of food. Ordinarily these changes would not cause obstruction, but added to congenital stenosis they hasten the formation of a vicious circle and the perpetuation of the obstruction.

Boyksen¹¹⁶ reports 2 extraordinary cases in which the *pylorus became suddenly occluded* as the result of some dietary indiscretion, or from the sudden complete closure of a previously existing partial stenosis. In both of the patients the cardia had become closed by a kind of valve formation and fermentation in the stomach had caused it to dilate extremely. No hope from conservative treatment is possible, and laparotomy with gastro-enterostomy is necessary without delay. The strength of the patient is lost so rapidly that a case may become inoperable in twelve hours; Boyksen ascribes the success in his 2 cases to the rapidity with which the laparotomy was done.

Gastric Ulcer. PATHOGENESIS OF GASTRIC ULCER. De Langen¹¹⁷ calls attention to the extreme rarity of gastric ulcer among the natives of Java; the condition seems to be rare also in Japan. Examination of the stomachs of 35 inhabitants of Batavia, healthy or ill with malaria or other disease, showed no deviation from the normal figures in respect to gastric acidity. The absence of vagotonia and the predominance of sympathicotonia in the tropics has caused Langen to accept the theory that vagotonia is the main factor in gastric ulcer and that the rarity of the neurologic disturbance in the East Indies is responsible for the rarity of ulcer.

It seems difficult to form any accurate conception of the actual cause operative among the natives of the far East which could account for the marked infrequency of gastric and duodenal ulcer among them; such knowledge is highly desirable. In the light of the little we know concerning functional, or other, disturbances of the autonomic nervous system, it seems, at the present writing, that vagotonic manifestations could just as readily result from the presence of a definite anatomical lesion, such as a gastric ulcer, as they could initiate the pathological formation; the bulk of the available evidence is more strongly in favor of the former assumption.

I spoke last year of the difficulties observers have in correctly sifting all the available, and newly acquired, facts concerning peptic ulcer with the object of correctly adjudging to each its proper place either as cause or effect. The assumption of de Langen, in regard to vagotonic and sympathetotonic manifestations, is another illustration of the limitations of laboratory facts and experiments as determined necessarily by

¹¹⁶ Deutsche medizinische Wochenschrift, 1919, xlv, 119.

¹¹⁷ Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, 1919, i, 178, Abstract, Journal of the American Medical Association.

the personal equation of the individual observer. It is quite natural, as pointed out previously when discussing shock, that anatomical lesions should be accompanied by a multiplicity of manifestations any one of which may, in any individual case, assume a more or less prominent role; such a dominance of any one symptom impresses different observers with different degrees of gravity; but to the disinterested person, not keyed to the pitch of expectancy, the dominance loses much of its importance and the phenomenon, which appears to one a cause, becomes in the eyes of another an effect, or, possibly, even an associated condition not necessarily having anything in common with the lesion which is being studied.

One thing, perhaps, is significant: We know how different and how simple, comparatively speaking, the customary food of the natives of the far East is, as compared with our own. It comes to one's mind that possibly our own foodstuffs, by virtue of those articles peculiar to us, or by virtue of some extraneous constituent accidentally incorporated during their preparation, carry the necessary factor capable of converting a temporary defect into an unhealable ulcer. The latter assumption is not at all unreasonable.

It is rather a curious fact that these observations should show a certain parallelism to those made by the same observer on the occurrence of gall-stone disease in the same quarters of the earth. I spoke of these findings last year.

Ulcers in the duodenum and jejunum, as well as in the stomach and pylorus, were produced by Jona¹¹⁸ by tying the pancreatic duct in dogs. The animals became emaciated, the hair fell out and they became altered temperamentally. In these cases the ulceration is attributed to the action of unneutralized acid gastric juice on the bowel mucosa. In the cases where ulceration occurred in the pylorus and stomach it is surmised that these were animals in which there was regurgitation of bile and pancreatic juice from the duodenum into the stomach which normally occurs in over 50 per cent. of individuals. The absence of pancreatic juice caused by a ligature of the duct gave the free hydrochloric acid full play. Possibly there were also other factors at work which determined the exact sites of the ulcerations. It is very probable that these experiments and their results have no bearing in elucidating the puzzle of gastric and duodenal ulcer inasmuch as in human life the common bile duct, except in cases of stone or tumor, is never known to become suddenly occluded; and when occlusion does occur, operating room and autopsy experience is abundant to show that it is extremely rare to find associated open ulcers in the wall of the stomach or duodenum.

PERFORATED GASTRIC AND DUODENAL ULCERS. It seems to be quite well established that the peritoneal inflammation accompanying an acute perforation is of a non-infectious nature in the first few hours of extravasation; later, however, it becomes very much so. Richter seems to be of the opinion that the determination of the mortality of operation

¹¹⁸ Medical Journal of Australia, 1919, i, 316.

for closure of these perforations, quite irrespective of the methods used in dealing with these emergencies, depends on the operator's technic. The reviewer is not altogether in accord with this statement: To be sure the personal equation is very important, and, when patients, who are desperately ill, are subjected to operation, the cleverness or clumsiness of an individual operator form deciding factors in the ultimate outcome; even this statement implies the much greater importance of the general condition of the patient; the final issue with any method of treatment varies with almost mathematical precision with the general powers of the individual patient to withstand the stress of even the simplest of operative procedures.

The work of the last few years has shown no perceptible improvement in the results of the operative treatment of acute perforations. The latest statistics, published by Hertz,¹¹⁹ still show that accurate diagnoses are being made in only approximately 25 per cent. of the patients; this necessarily entails a preoperative period, extending in a deplorably large number of patients, over and much beyond the favorable first six hours, after which time mortalities range from 35 to 80 per cent.

A very curious case of gastric perforation is reported by Friedenwald,¹²⁰ extraordinary in its method of healing: A ruptured gastric ulcer created a localized abscess formation and the latter perforated spontaneously into the thorax and lung and discharged through a bronchus, with subsequent cure.

DIAGNOSIS OF PEPTIC ULCER. The present position in regard to the differential diagnosis of ulcer is not very much different from the unsatisfactory position in which it has been for the past few years, and is expressively put by Cheney:¹²¹

"We have heretofore been too ready to diagnose ulcer, when it did not exist, because the history was typical; but now we have learned how many other conditions simulate this history, and we demand other data in addition to the patient's story. On the other hand, when the history was not typical, ulcer was not suggested by it and we were likely to overlook its existence because our other means of recognition were so meager. Now we have learned that the patient's story of his ailment is not always the same; that some feel less discomfort from an ulcer than others do; and that only part of the classical symptoms may be present, even when hyperchlorhydria is found and roentgenograms show definitely a pyloric defect or a deformed cap. The only way to avoid error, therefore, is to trust to no one element in the diagnosis; but to collect our data by history, by physical examination, by laboratory reports, and by fluoroscopic examinations and roentgenograms; and then to piece these data together as a child does the parts of a picture-puzzle, to see what they will ultimately make."

TREATMENT OF GASTRIC AND DUODENAL ULCER. Bevan¹²² is convinced that the great majority of gastric and duodenal ulcers can be

¹¹⁹ Ugeskrift for Læger, Copenhagen, 1918, lxxx, 1801.

¹²⁰ American Journal of Medical Sciences, 1919, cviii, 179.

¹²¹ Journal of the American Medical Association, 1919, lxxii, 1429.

¹²² Transactions of the American Surgical Association, 1919.

cured by medical means and can be kept cured under proper after-treatment. He believes, however, that most medical men push the matter of medical therapy too far; an ulcer persisting after proper medical treatment becomes a surgical malady.

Other things being equal, when once surgical treatment is decided upon, excision of the ulcer, or resection, followed by gastro-enterostomy is the procedure of choice adopted by Deaver.¹²³ Gastro-enterostomy, of itself, is a curative measure only for a time; to insure a positive result the ulcer must be removed. It has been Deaver's experience that a gastro-enterostomy properly made and properly placed does not close in the presence of a patulous pylorus. Resection of the ulcer-bearing area plus gastro-enterostomy presents the same advantages as the less complete operation with the added benefit derived from a direct attack on the pathological lesion itself.

Abroad there seems to be more content with the operation of gastro-enterostomy alone, although dissatisfaction can be seen there also. At the Fifth Swiss Surgical Congress, Kummer¹²⁴ brought out statistics to show that gastro-enterostomy offers two or three times less vital danger than resection and excision, while the functional results are equally as good irrespective of the site of the ulcer. Albert Kocher¹²⁵ agrees with Kummer and believes that gastro-enterostomy is still, as ever, the preferable operation for gastric and duodenal ulcer. Bircher,¹²⁶ however, is very frank about saying that gastro-enterostomy has not answered all the expectations and he ascribes this to the functional factors involved in the ulcer. There is a great deal in the latter part of this statement and one should be on the lookout for such disturbances in the post-operative care of the ulcer cases. (Reviewer.)

Balfour¹²⁷ points out the shortcomings of gastro-enterostomy in those cases of ulcer in which bleeding formed one of the prominent symptoms. In the Mayo records, one or more gross hemorrhages occurred in 20 to 25 per cent. of the cases. Among these, 12.7 per cent., who had had bleeding before, had the same after operation; 0.9 per cent. had bleeding after operation as a new symptom. In not one of 83 patients, in whom hemorrhage occurred after operation, had the combined operation of excision of ulcer and gastro-enterostomy been done; the combined operation was done in only one of 17 cases in which there was bleeding after operation. In the majority of these the postoperative bleeding was the only symptom which marred an otherwise perfect result; and reoperation with radical treatment of the ulcer area obviated further hemorrhage.

We seemed to be passing through a transition stage insofar as the treatment of peptic ulcer concerns us. In the beginning, gastro-enterostomy was deemed sufficient and it was not until some time had passed, and the inefficiencies of the method of operating were brought home to us more and more, that new methods, or rather new additions to the old method of gastro-enterostomy, were diligently looked for in the hope

¹²³ Transactions of the American Surgical Association, 1919.

¹²⁴ Correspondenz-Blatt für Schweizer Aerzte, 1919, xlix, 673.

¹²⁵ Ibid.

¹²⁶ Ibid.

¹²⁷ Journal of the American Medical Association, 1919, lxxiii, 571.

of securing a reliable means of curing ulcerative conditions. A great deal of importance has been attributed to the method of making the anastomosis—to the relative point of the stomach at which the implantation is made, to the direction of the loop, to the size and direction of the stoma, to the kind of suture material used, and to the skill with which the necessary manipulations are carried out; and there are men who do not hesitate to say that the personal equation of the operator is of such importance as to make the proper fashioning of the stoma an art which does not universally exist among surgeons. Much of this seems quite true, as the records of any large hospital will show, and numerous sequelæ, which follow after this operation, are consequences of the manner and method by which the stoma is made. But, unfortunately, this is so only in a very small minority; and experience has multiplied the cases in which recurrences of symptoms follow operations concerning any part of which no criticism is permissible.

There does not seem to be any accurate knowledge of the exact factor in the functioning of a gastro-enterostomy which exerts the beneficial effect, which is said to follow, and which assures the healing of the ulcer. Opinions have, and do still, differ and vary from the belief that the desirable factor is purely mechanical in helping to empty the stomach in a shorter than normal interval or, at least, in side-tracking the food away from the ulcerated area, to the more prevalent interpretation that the good effect resides in the continued partial, or complete, neutralization of the hyperacid condition of the gastric secretion. In the absence of definite proven data of the actual factors causing the so-called good effect, theories as to why the gastro-enterostomy is followed by so many recurrences, both of symptoms and ulcers, seem to be based on insecure foundations, and no criteria are available upon which one can accurately base the modifications with which one seeks to improve the results of gastro-enterostomy, or upon which one can construct more reliable methods of operative, or other, treatment.

The practical failure of the various modifications to which gastro-enterostomy has been subjected in the hope of making it reliable, are directly attributable to this state of affairs. For a while it seemed that unilateral exclusion of the pylorus was the wanted addition; but experience has shown that the various methods of occlusion proposed and practiced, either do not exclude, or when they do, become associated with new conditions which are very frequently liable to cause disturbances distressing to the patient both from their own manifestations and from the added impediment they furnish, if the gastro-enterostomy should, for some reason, contract to too small a calibre for the adequate emptying of the stomach.

In recent years the dissatisfaction with these measures has caused a diametrically opposite swing of opinion and "radical" operations are being talked of more and more; these include as a requisite the thorough excision of the ulcer-bearing area either by local excision of the stomach or duodenal wall, or by a resection of the pyloric end of the stomach. With increased practice and experience the relatively large mortality,

which had at first followed these radical operations, has been reduced, and while it is still considerably larger than that which follows a gastro-enterostomy, the added danger has seemed justifiable of acceptance by the more experienced men because of the greater reliability of the more permanent result, because of the obviation of certain annoying and dangerous complications, such as hemorrhage, and because of the prevention of the possibility of the retention of any carcinomatous structure.

The methods of excision are, in general, one of three: The local area surrounding and containing the ulcer is removed by knife or cautery and the resulting defect is closed in such a way as to obviate, if possible, any resultant deformity of the stomach. Anywhere in the stomach the procedure is very easily done, but it is usually found that sufficient disturbance of normal gastric motor function results as to cause considerable distress to the patient. These annoyances can be almost entirely removed by making a gastro-enterostomy; and the general practice, nowadays, is to do both of these procedures at the same time. Lesions near the middle segment of the stomach, especially those on the lesser curvature, lend themselves quite readily to a sleeve resection, and the functional results are quite superior to those obtained by a V-shaped resection of the ulcer-bearing area, so much so that no further operation is necessary despite the fact that considerable deformation of the stomach follows this type of operation. The third method includes the various forms of stomach resection: These seem to yield the best results. In the duodenum, excision of the ulcer-bearing area is not so readily accomplished, and when it can be done, plastic operations of the nature of Finney's pyloroplasty, or gastro-enterostomy are necessary to overcome the artificial narrowing of the lumen.

POSTOPERATIVE SYMPTOMS. None of these various methods are ideal, however, and numerous recurrences of symptoms testify amply to the fact that the last word has not been said in the treatment of ulcer, and account for the diligent efforts which are everywhere being made to improve the surgical method of therapy for gastric and duodenal ulcer. We have come to the stage where both medical and surgical men have each recognized the inadequacies of their own particular field; a sensible viewpoint seems to be becoming prevalent whereby both are combining forces in the therapeutic management of the disease. As a general rule this includes a preliminary attempt at medical cure, in which, if no other good be accomplished, the patient is brought into a more favorable and satisfactory condition for the employment of the middle-step—the surgical operation. This latter always includes, whenever it is possible so to do, the thorough removal of the ulcer-bearing area.

Operation is, more and more, being regarded as one of the incidents in the cure of the ulcer, as a means towards the desired end, the accomplishment of which may, and frequently does, necessitate further means; especially is it necessary to give much attention to the dietary regulations which are to be carried out for long periods of time after operation. These combined methods of treatment naturally resulted from the necessity the medical men had of treating numerous postoperative symptoms in the operated cases. Just how the combined method works

out in actual practice can be gleaned from the report made last year by Richards.¹²⁸

The combined treatment adopted by Richards embraced preliminary medical measures which included the control of the free acid and pain by alkalies, and, in many cases, by belladonna, and a long course of dieting. Of the medically-treated patients, 40 per cent. returned later for operation. The mortality of the medical treatment was *nil*. The surgical treatment consisted of a posterior gastro-enterostomy. The average time that the patients remained under medical care following the operation was three months. Eighty-five per cent. of the patients report very satisfactory results from the combined surgical and medical treatment. Richards emphasized particularly that there has been gross neglect on the part of the surgeons doing stomach work in the matter of postoperative treatment. A gastro-enterostomy of itself does not cure an ulcer, either gastric or duodenal; it is merely a means to that end.

It is well to realize that, while whatever type of operation which is performed may conceivably be followed by a cure of the ulceration, yet postoperative symptoms may be many and distressing which are due to other causes. Most of the trouble after operation is caused by dietary indiscretions. Postoperative symptoms do not always indicate that organic lesions are present, and in many the disturbances of a functional nature are directly induced by manifold indiscretions in diet, or by the too rapid and early introduction of highly acid gastric contents into the jejunal portion of the alimentary canal. In cases with marked disturbances of the secretory and motor function, which had accompanied the ulcer prior to operation, the tone of the stomach is much disturbed and while the immediate effect of operation may be all that is to be desired, especially from the patient's point of view, very soon the effects of the pre-operative disturbances come to the surface again to be cause for greater or less distress until the normal condition is reached, or, as more often happens, approximated.

Such functional disturbances are the causes for symptoms after operation in the greatest number of the cases. In a great number of these it is to be presumed that the original ulcer has healed and that no new ulceration has appeared. And yet, the operation—and I speak now of a gastro-enterostomy alone—has distorted the physiology to such an extent as to be cause for subjective symptoms. Such a state of affairs brings to one's mind the question, when these functional symptoms persist, and when one assures oneself at operation that they are based on no organic lesion—whether it would not be wisest to cut away the jejunal loop and restore the normal continuity of the alimentary canal; such a procedure would only be possible in those cases in which at the primary operation no handicap to the subsequent reestablishment of normal conditions had been introduced in the form of some permanent, unrelievable impediment (pyloric exclusion) to the overflow of gastric contents through the pyloric antrum.

In considering all of the symptoms, it is well to note that any type of

operation which is done causes a distortion of the normal structure, or relations of the stomach and, probably, of the nervous mechanism controlling the normal physiology. Even when all the wounds are surgically healed in a manner most acceptable in the present state of our knowledge, certain changes in the physiology are inevitable because of the abnormal anatomy and are probably fertile causes for the appearance of postoperative functional complaints. Whether these are to be permanent, or whether these are to be temporary disturbances susceptible to spontaneous adjustment, is difficult of decision, but it seems that in almost all a definite change has taken place which necessitates a readjustment with, or without, the aid of medical men. The conception furnishes a ready explanation of the good results which usually follow a gastro-enterostomy for cicatricial pyloric stenosis: Here an abnormality existing for a long period of time has caused a disturbed physiology and has gradually, and efficiently, prepared the organ for some new point of exit; our operation assists nature in the compensatory adjustment of the initial condition and the result follows quickly with a minimum of postoperative symptoms.

GASTROJEJUNAL ULCERS. In a minority of the operated cases organic lesions are causes for the postoperative symptoms. Besides those with mechanical obstructions at the points of egress from the stomach, there are the cases of persisting or recurring ulcers, or of newly formed ulcers in the general neighborhood of the stoma—the so-called gastrojejunal ulcers. Some of the cases in the first group—the contracted stoma cases—are frequently due to the healing and secondary contraction of gastro-jejunal ulcers when they form at the line of junction of stomach and bowel.

"The occasional occurrence of ulceration in the jejunum, or at the anastomosis, after the operation of gastro-enterostomy, is a serious drawback in view of the fact that the complication is usually more serious and its cure entails more severe operative measures than the original condition for which the gastro-enterostomy was done."

Quoting Patterson, Wright¹²⁹ differentiates two types in accordance with the location of the ulcer:

1. The gastro-jejunal ulcer, located at the line of anastomosis and usually ascribed to some fault in technic, such as the failure to cast off promptly some unabsorbable suture material, or the want of accurate apposition, or the occurrence of excessive marginal necrosis.

2. The jejunal ulcer occurring some distance from the line of anastomosis usually in the efferent loop. Wright explains the formation in this locality as due to the action of non-inactivated gastric juice; the view is supported by Moynihan.

There are two clinical types: (1) The acute jejunal ulcer, resembling the acute ulcer of the stomach, spreading rapidly, perforating frequently and producing peritonitis. This occurred 21 times after 74 anterior, and 10 times after 61 posterior gastro-enterostomies. (2) The chronic ulcer, setting up a local peritonitis by which the ulcer becomes adherent

¹²⁹ British Journal of Surgery, 1919, vi, 390.

to surrounding structures; a large inflammatory swelling forms. After an anterior gastro-enterostomy the swelling tends to adhere to the anterior abdominal wall; a process of chronic perforation then occurs and the ulceration may extend through the anterior abdominal wall and produce an external fistula. (Wright.) After a posterior gastro-enterostomy the process burrows into a neighboring hollow organ, usually the colon.

Wright points out the fact as noteworthy that there is an extraordinary preponderance of these secondary ulcerations in the male sex.

In his cases the preliminary operations were as follows:

1. Anterior gastro-enterostomy	38 cases
2. Anterior gastro-enterostomy with entero-anastomosis	26 "
3. Anterior gastro-enterostomy with entero-anastomosis in Y	10 "
4. Posterior gastro-enterostomy	54 "
5. Posterior gastro-enterostomy with entero-anastomosis	3 "
6. Posterior gastro-enterostomy with entero-anastomosis in Y	5 "
7. Partial gastrectomy	2 "
8. Not definitely stated	7 "

Patterson¹²⁰ and others lay great stress on the increase of acidity of the gastric contents as an etiological factor. On the other hand there are records of cases in which a hypo-acidity was demonstrated. Errors in technic are important in the gastrojejunal, as against the true jejunal ulceration. In 14 cases the stoma had been made by a Murphy button or with the aid of a bobbin. The opinion is constantly increasing that unabsorbable suture material in the stoma has been, and is, a prolific source for these secondary ulcerations. For this reason the custom is becoming prevalent of employing absorbable suture material, usually chromicized catgut, for all the layers in the stoma, inasmuch as it seems to be conclusively proved that the outer layer of sutures can, and frequently does, work its way into the lumen. Records are not wanting to show that suture material embedded in the stoma may lie quiescent for several years before it begins to work its way out and produce symptoms and an ulcer. In the reviewer's experience, both in the operating and autopsy rooms, these "suture" ulcers show no resemblance of any kind to any defect which a pathologist would accept under the terminology of ulcer. Usually one finds a thread hanging from the mucosa side of the viscus and protruding outward from a long, extremely narrow canal in the wall of the anastomosis, and extending to a point of fixation of the thread somewhere in the outer suture layer where it lies embedded in a much thickened peritoneal coat. Quite obviously this is no ulcer, as the term is generally accepted, but simply a path through which a foreign body is being extruded; and the assumption seems to be correct inasmuch as, microscopically, the edges of the pathway have no resemblance to an ulcer in that a minimum of inflammatory reaction surrounds it. The manifestations of such "suture ulcers" may be quite out of keeping with the relative insignificance of the anatomical lesion and the reviewer has himself seen cases in which most extensive hematemeses have occurred, and have been repeated, to the great anxiety of both patient and doctor.

¹²⁰ Quoted by Wright.

Wright¹²⁰ points out other sources, perhaps of error, by virtue of which these secondary ulcerations make their appearance. These include (1) hematoma formation in the mesocolon (Mayo); (2) the pressure of clamps—this cause has been suggested but not proven; (3) acute septic infection where the ulcers are multiple. In most cases some injury of the mucous membrane is assumed; this last is perhaps not exclusively so.

The problem of the gastrojejunal ulcer is particularly baffling. For whereas in the ordinary varieties of gastric and duodenal ulcers we have had nothing to do with creating the unhealable defect, in the gastrojejunal ulcers, we have, ourselves, ploughed and planted the field upon which, later, the ulcers appear. The entire life history is open to us but up to the present no success has followed in elucidating the problem. It seems that the various factors about which much is said as etiological causes, play an insignificant part; otherwise the number of gastrojejunal ulcers would far exceed the 2 or 3 per cent. of all the gastro-enterostomies which are done.

The symptoms include pain, vomiting, hematemesis, local tenderness, rigidity, and frequently a local swelling. Perforation into the colon gives a definite complex—rapid and extreme emaciation, diarrhea of the lenteric type, vomiting of fecal matter or eructations of gas with a fecal odor. Perforation into the free peritoneal cavity gives the usual symptoms.

According to Carman and Miller¹²¹ who studied roentgenologically 14 cases of gastrojejunal ulcers, the following x-ray manifestation should be sought in order to establish a diagnosis.

1. Deformity of the stoma, which can be made visible by lifting up the overhanging lower border by manual pressure and exposing the anastomosis, if it is on the horizontal part; or examining in the oblique position if the anastomosis is on the vertical part.

2. The dimpling at the point of anastomosis is exaggerated and irregular. If a gastrojejunal ulcer develops after an anterior gastro-enterostomy, the ulcerated area may be so thickened as to give rise to a palpable mass.

3. Narrowing and deformity of the afferent loop of jejunum.

4. Patency of the stoma is not free, as evidenced by the narrow stream of the contrast substance and by a marked six-hour residue.

5. Exaggerated peristalsis of the stomach.

6. Lessened mobility of the stomach if adhesions are present.

7. Spasticity of the stomach due to reflex irritation.

8. Dilatation of the duodenum.

Not all signs must be present. The most significant are the deformity and irregularity of the afferent loop, narrowing of the stoma, and the exaggerated dimpling, and sometimes the formation of a pouch at the stoma.

Certain lines of *preventive treatment* are suggested by Wright: He recommends a suture operation always for the gastro-enterostomy,

¹²¹ Quoted by Gross and Held, *Surgery, Gynecology and Obstetrics*, December, 1918, 567.

and, whenever possible, absorbable sutures; the modern posterior, no-loop operation is preferable. Theoretically, a gastroduodenostomy is best, as no ulceration has been reported thereafter.

Surgical interference must be regarded as unsatisfactory. Wright reports that of 145 cases, 19 died without operation. In 93 cases, 1 intervention was made; in 26 cases, 2 interventions were necessary; in 5 cases, 3 interventions were necessary; and in 2 cases, 4 interventions were necessary. The *end-results* included 38 deaths; 25 cases with no, or incomplete, relief; and 82 well cases. This last is probably exaggerated. (Wright.¹²⁹)

During the laparotomy undoing of the anastomosis with restoration of the normal path should always be considered first; next a large no-loop posterior gastro-enterostomy. With stenosis of the pylorus these can be combined with a gastroduodenostomy or with Finney's operation. Medical treatment is also necessary.



FIG. 39.—The incision is made from a point on the anterior surface of the duodenum not farther from the pylorus than one inch, extending into the stomach, midway between the greater and lesser curvatures, not less than two inches. These points are fixed with forceps or sutures before the gauze is placed. (Horsley.)

COMPLICATIONS AND SEQUELÆ OF GASTRO-ENTEROSTOMY. In cases of *vicious circle after gastro-enterostomy*, Vulliet¹³² recommends dividing the duodenum at the pylorus and closing the pyloric end of the stomach. The end of the duodenum is swung around and sutured to the left side of the efferent loop. This method of doing an entero-anastomosis has been tried by Vulliet upon the cadaver; but he acknowledges that the procedure is difficult and would probably be risky on the living subject.

Warren¹³³ reports a very remarkable sequela of gastro-enterostomy.

¹³² Revue Médicale de la Suisse Romande, Geneva, 1918, xxxviii, 673.

¹³³ Lancet, London, 1919, ii, 615.

Thirteen years after operation a *retrograde intussusception of the jejunum* occurred through the stoma. Symptoms had been present for one year preceding—pain after meals which was relieved by vomiting. It was possible during the laparotomy, to reduce the intussusception, but, unfortunately, the patient succumbed to a bronchopneumonia with subsequent abscess formation.



FIG. 40.—The opening of the stomach has been made; first, by cutting down to the gastric mucosa and clamping as many vessels as possible before opening the mucosa; then the incision is extended into the duodenum for not more than one inch. The ulcer is excised from the mucous surface. (Horsley.)

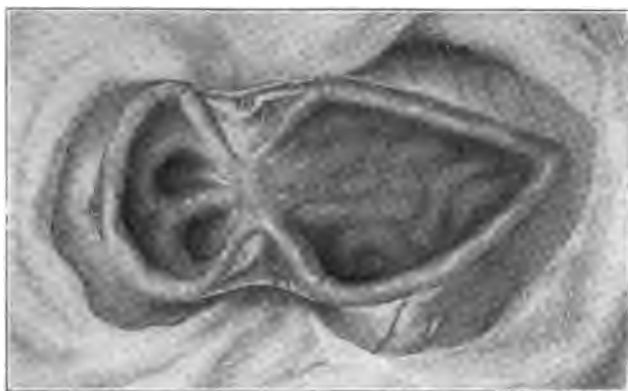


FIG. 41.—If there is marked stenosis, pockets will result on the duodenal side. These are obliterated by incisions of the mucosa and of the constricting bands. To avoid hemorrhage these incisions should be short and not too deep. (Horsley.)

NEW OPERATION FOR ULCER. A new operation for duodenal and gastric ulcers is described by Horsley.¹²⁴ The new procedure is, practically, a Heinecke-Mikulicz operation in which the large opening is utilized as a gastrotomy through which intragastric lesions are radically

¹²⁴ Journal of the American Medical Association, 1919, lxxiii, 575.

attacked. The figures illustrate the steps of the operation. One of the advantages claimed is that the sphincter action is destroyed. (Horsley likens the pyloric ulcer to an anal ulcer.) The sphincter is said to restore itself after several weeks. It is supposed, however, never again to become spastic.



FIG. 42.—In the first step of closing the incision, a suture of tanned catgut is inserted from the end of the stomach incision to the end of the duodenal incision. Then a second suture is placed half-way between this stick and the upper angle of the wound. (Horsley.)

In a woman of forty years, Alvarez¹³⁵ cured some indefinite stomach symptoms by the removal of a lipoma straddling the upper spine. In other patients, and for similar symptoms, Alvarez sought to imitate the same effect by cutting the nerves of the same level—sixth, seventh, eighth and ninth pairs of intercostal nerves. The latter were stretched, severed, and twisted. He gives the details of the cases cured of ulcer, hyperchlorhydria, hypersecretion, spasm, or even ectasia. The benefit from this operation confirms in Alvarez's mind the assumption that nervous influences induce the stomach condition; they shut off the blood supply which permits autodigestion. By cutting the nerves this is relieved; the blood supply returns, and the ulcers heal spontaneously notwithstanding the persistence of the hyperchlorhydria. (The operation has many similarities to that devised for the relief of gastric crises of tabes. Reviewer.)

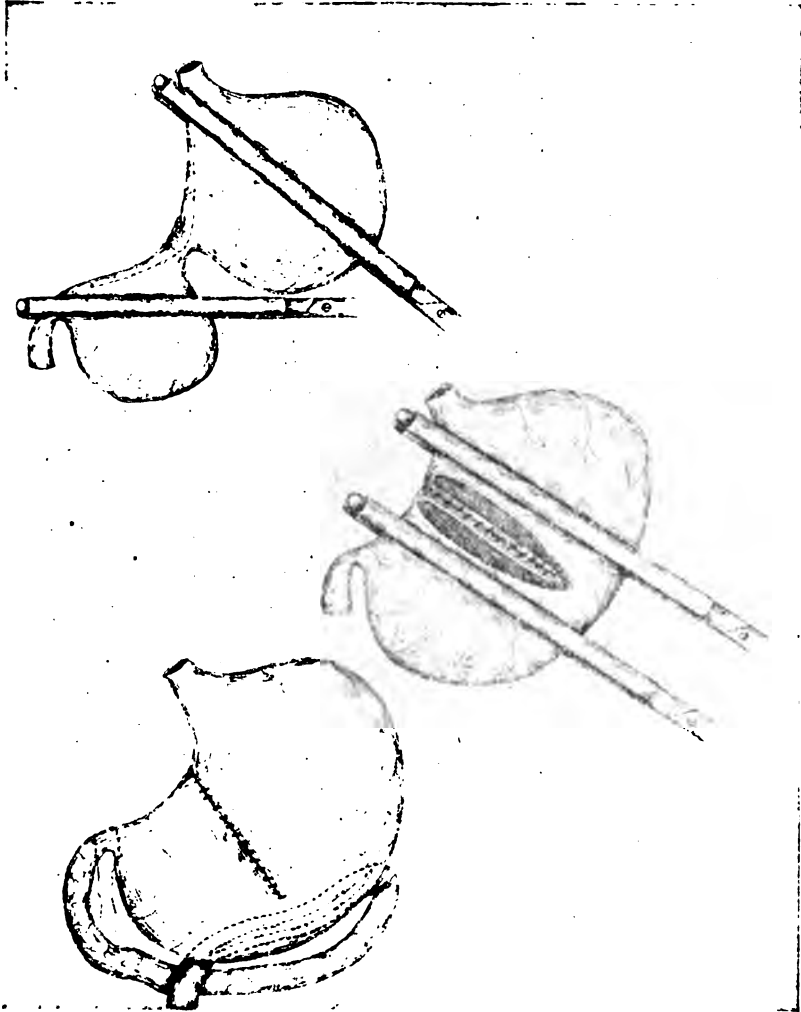
Hour-Glass Stomach. According to Walton,¹³⁶ statistics show less than 70 per cent. of cures after operation for hour-glass stomach. The various operations suggested include:

1. Digital dilatation—this is one of the earliest operations proposed and is now abandoned.

¹³⁵ *Semana Medica*, Buenos Ayres, 1919, xxvi, 30; Abstract, *Journal of the American Medical Association*.

¹³⁶ *Surgery, Gynecology and Obstetrics*, 1919, xxix, 213.

2. Gastropasty: (a) similar to Allingham or Heinecke-Mickulicz pyloroplasty; (b) similar to Finney's pyloroplasty and introduced by Kammerer. These, as shown by Patterson, are insufficient in 25 per cent. of the cases.



FIGS. 43, 44 and 45.—Walton's method.

FIG. 43.—Clamps placed obliquely across the stomach. The amount of the stomach wall to be excised is indicated by the dotted lines.

FIG. 44.—Clamps placed parallel to one another. Suture of stomach opening commenced. The posterior seromuscular layer of sutures has been passed.

FIG. 45.—Opening in stomach completely closed. Posterior gastro-enterostomy with horizontal opening performed. Silk suture passed ready to occlude pylorus but not tied. (Walton.)

3. Gastrogastrostomy, advocated by Wolfler; this method, also, was shown by Patterson to be insufficient in 30 per cent. of the cases.

4. Single gastro-enterostomy—of necessity on the cardiac side of the constriction.

5. Double gastro-enterostomy, advocated by Weir and Foote; this is generally regarded as the method of choice and is endorsed by Sherren and Patterson.

6. Partial gastrectomy.

7. Walton's method: this includes (a) a long V-shaped excision of the ulcer, so that the lumen after excision is at least four and one-half inches wide; (b) a pyloric exclusion by the string method; and (c) a posterior gastro-enterostomy by the usual method. Good results are reported in 10 cases; in 1 case the ulcer recurred.

Pauchet¹³⁷ has operated in 21 cases of hour-glass stomach. His best results are obtained with extensive resections; in 2 cases a secondary operation was necessary because the first was too conservative. Regional, or spinal, anesthesia was exclusively used. Five types of complications were observed: Stenosis of the duodenum accompanying the bilocular constriction of the stomach; ulceration extending to and involving the abdominal wall, liver or pancreas; cancerous degeneration; perigastric abscess; a fistula into the colon corresponding to the constricted point; volvulus of the pyloric portion closing the opening of the mediogastric constriction completely; and acute obstruction of the opening. The bilocular deformation results from a healing ulcer, or, more frequently, from a callous ulcer in full evolution. Treatment, as for syphilis, may be tried, if the general health is good; otherwise it is better not to wait.

A case of *trifid—double hour-glass—stomach* is reported by Burke.¹³⁸ It is described as being due to intrinsic contraction after multiple ulcers and is believed to be the only case of its kind on record.

Results of Operation for Gastric and Duodenal Ulcer. A novel way of determining the mortality after operations for gastric and duodenal ulcers was employed by Hobbs,¹³⁹ who, at the request of the Association of Life Insurance Directors, studied this question. Patients of the Mayo clinic were utilized and the subsequent histories were further obtained from the records of the Life Insurance Companies; the total was 96 per cent. of reports. Five hundred and forty-five operations for gastric ulcer yielded an operative mortality of 24, or 4.5 per cent. During observation for 3.6 years, 88 died, or 17 per cent. Sixteen hundred and eighty-four operations for duodenal ulcer yielded an operative mortality of 33, or 2 per cent. During an observation period of 3.4 years, 85 of these died, or 5 per cent. Ninety-one unoperated gastric and duodenal ulcers were followed for 3.8 years; 9 of these died, or 10 per cent.

Leaving aside all the cases that have been observed for less than one year, Schwyzer¹⁴⁰ has reports from 91 patients; of these, 62 are "well," 12 are "greatly improved," 15 are "improved" and 2 are "temporarily improved." Over one year there are reports from 72

¹³⁷ Presse Médicale, 1919, xxvii, 405.

¹³⁸ Surgery, Gynecology and Obstetrics, 1919, xxix, 75.

¹³⁹ Journal of the American Medical Association, 1919, lxxiii, 57.

¹⁴⁰ Minnesota Medicine, 1918, ii, 134.

patients; of these, 49 are "well," 12 are "greatly improved," 11 are "improved." Over five years there are reports from 47 patients; of these, 31 are "well," 9 are "greatly improved," 7 are "improved." Over twelve years there are reports from 10 patients; of these, 8 are "well," 1 is "greatly improved" and 1 is "improved."

There were 15 acute stomach perforations; the mortality was 27 per cent.

According to the kind of operation performed, there were 86 gastroenterostomies with 2 deaths, mortality of $2\frac{1}{2}$ per cent.; 13 Finney pyloroplasties with 1 death, a mortality of 8 per cent.; 13 gastroplications, with no mortality. 20 resections, with 1 death, a mortality of 5 per cent. Schwyzer feels safe in concluding that the patient who is relieved from his symptoms for one year almost always remains cured.

Relationship of Ulcer and Carcinoma of the Stomach. For a number of years American opinion in regard to the relationship of ulcer and carcinoma of the stomach has been greatly influenced by the reports of Wilson, McCarthy and others that ulcer precedes carcinoma in a rather large proportion of the cases. Originally the figures were put very high, almost three-fourths; latterly the percentage relationship has shown a decrease. In other quarters, especially among men who were more inclined to look upon the lesion from a purely pathological light, the opinion tended to the opposite, did not recognize such a large percentage relationship, assumed that the carcinoma had preëxisted in the largest number, and that the ulceration was a secondary phenomenon unrelated in its formation to the mechanism of a benign lesion and was due directly to the amount of necrosis which so frequently takes place in any new growth. Among the latter group of men it was estimated—Ewing, Wilensky and Thalhimer—that this biological sequence (ulcer to carcinoma) did not occur in more than 2 or 3 per cent. of the cases.

It is rather curious that abroad the opinion has always, and most commonly, agreed with the latter point of view; perhaps this was so because in the European centers opinion is usually based and decided upon evidence obtained in the postmortem room, and no clinical considerations are allowed to bear very much weight. At the last Swiss Surgical Congress, Albert Kocher¹²⁵ emphasized the rarity of malignant degeneration, saying that the wide divergence in the figures of different surgeons—from 0.5 to 70 per cent.—is undoubtedly due to errors in interpretation. He related that he had personally examined many American specimens and was convinced that much that was labeled cancerous degeneration was, in reality, only atypical proliferation. Regenerative changes in the gastric glands assume most peculiar shapes and we have no means, to date, to differentiate them except by the outcome.

There were two communications last year which entered into the discussion of the causal relation between ulcer and carcinoma. Both Gross and Held¹⁴¹ and Douglas¹⁴² agreed that all the various authorities seemed to be in unison as to the actual occurrence of the carcinomatous degener-

¹⁴¹ Surgery, Gynecology and Obstetrics, December, 1918, 567.

¹⁴² Ibid., xxviii, 76.

ation of a benign gastric ulcer, but that there were marked differences of opinion as to the actual percentage relationship. Gross and Held seem rather inclined to side with those who believe that the sequence of events is, in the majority of the cases, from carcinoma to ulcerating defect; the converse, they believe, occurs rather uncommonly. Douglas, on the other hand, takes the opposite viewpoint impelled thereto very strongly by the published statistics and views of the men from the Mayo clinic. To Douglas the results after gastro-enterostomy are the strongest presumptive evidence against carcinomatous degeneration of ulcers but he acknowledges that an explanation of this phenomenon is not inconceivable based on the rapid healing which usually occurs in ulcers near the pylorus after operation, on the theory of the possible inhibition of cancer formation after gastro-enterostomy (Gressot's view¹⁴³), and on the possible digestion of sloughing carcinomas. (Wilensky and Thalhimier.¹⁴³)

As the cases are met on the operating table, the difficulty practically always arises with the large crateriform ulcers on the lesser curvature and posterior wall. The gross appearances of these frequently do not betray their microscopical structure. The truth is that many of the lesions show every characteristic, in their gross appearance, of a benign lesion and their malignancy is only apparent under the microscope. The important point to remember is that, in actual practice, it is much safer and better to regard every one of these lesions as potentially malignant growths. The method of treatment should then be obvious and whatever else it will include, it will accomplish a thorough removal of the lesion.

Carcinoma of the Stomach. According to Deaver¹⁴⁴ the value of the x-ray in surgical conditions of the stomach lies in demonstrating a lesion; a greater value, however, lies in the ability of the ray to demonstrate the lesion at a very early stage. Carman, writing from the experiences of the Mayo Clinic, believes that the x-ray signs, when correlated with clinical data, offer the most promising means by which the stage of operability of the lesion can be foretold. The x-ray can now discover 95 per cent. of gastric cancers, only 50 per cent. of which are still in an operable stage. As the chances of metastatic formation and general operability contra-indications advance with the age of the lesion, it seems that the x-ray ought to prove more and more valuable in detecting the tumors at the most early stage possible. So many seemingly benign lesions of the stomach turn out later to be of a malignant structure that the advisability of any medical treatment seems to be increasingly questionable. Carman points out that periodic examinations can be made in suspected cases, but when signs, which seem decisive, are at last discovered, the stage of operability, owing to metastatic formations, may have long since passed. The sane viewpoint seems to be to determine the presence of a surgical lesion at the earliest possible moment; then operation is immediately indicated, perhaps frequently of an exploratory nature to insure the radical removal of the cancerous growth at an operable moment.

¹⁴³ Quoted by Douglas.

¹⁴⁴ New York Medical Journal, 1919, cix, 749.

The results of Perez's¹⁴⁶ extensive resections for carcinoma are very encouraging. Even those in advanced cachexia bear the operation well. Pneumonia is the most dreaded of all postoperative complications. A palliative gastro-enterostomy is sometimes followed by quite a long survival as some cancers grow very slowly. The results of operation at the Mayo clinic are as follows:¹⁴⁶ From October 1, 1897 to January 1, 1919, 2094 operations for cancer of the stomach were performed; 736 of these were resections, with a mortality of 13.7 per cent.; 746 were explorations, with a mortality of 2.9 per cent.; and 612 were palliative operations, with a mortality of 11.1 per cent. Hartmann¹⁴⁷ cites statistics to show the constantly increasing proportion of cures after operation for gastric cancer. He has traced 3 of his own cases for five years, 3 for six years, 2 for seven years and 1 for thirteen years.

Stomach Resection. Finochietto¹⁴⁸ describes a *new instrument* of his own which crushes the stomach at the line of division into a small cylindrical stump no larger than an appendix. A clip is placed doubly, the part between is cut and each end is buried like an appendix stump.

Tagliavacche¹⁴⁹ indicates a method for *the protection of the duodenal stump* after resection. When the pyloric end is cut through, it is turned back, like a barn door, leaving the posterior peritoneum intact. A flap is cut in the latter peritoneum, hinged on the level of the cut in the duodenum; this is turned forward to protect the duodenal suture line with a special triple row of sutures.

The *Polya operation* for resection of the stomach seems to be growing in favor in certain quarters, especially at the Mayo clinic¹⁴⁷ where this type of operation has been done for a number of years; much better results seem to be obtained than after the old types of resection. For the last three years the anterior, instead of the posterior, implantation of the jejunal loop has been done at the Mayo clinic. Better after-results seem to be obtained by turning the bowel to the right, isoperistaltic, by closing the end of the stomach in toward the lesser curvature, and by protecting the closed portion by suturing the unopened bowel over it.

Allende's¹⁵⁰ experience with the Polya type of resection confirms its superiority over the older types of resection.

Soresi¹⁵¹ describes the various steps of his newly devised technic for gastrectomy, and gives the results in a dog two years after operation, and the clinical course in two patients. The advantages claimed for his technic are that the natural anatomic and physiologic conditions are restored better than with any other method, and that each step is

¹⁴⁶ Tumori, Rome, April, 1919; Abstract, Journal of the American Medical Association.

¹⁴⁶ Transactions of American Surgical Association, Annals of Surgery, 1919, lxx, 236.

¹⁴⁷ Presse Médicale, 1919, xxvii, 245.

¹⁴⁸ Prensa Medica Argentina, 1919, v, 240; Abstract, Journal of the American Medical Association.

¹⁴⁹ Ibid., 145; Abstract, Journal of the American Medical Association.

¹⁵⁰ Ibid., 242; Abstract, Journal of the American Medical Association.

¹⁵¹ Clinica Chirurgica, Milan, 1917, xxv, 585; Abstract, Journal of the American Medical Association.

facilitated by the one preceding. A division of the jejunum is made a short distance below the duodenojejunal fold. The distal stump of the jejunum is sutured to the lowest point of the vertical raw edges of the stomach after the edges above have been sutured. Then the proximal stump of the jejunum is implanted low down in the distal jejunum with an end-to-side suture. The stump of the duodenum is inverted with a sero-serosa suture. The operation is practically a composite Polya-Billroth I resection followed by an entero-anastomosis in Y as in Roux's operation.

The following technic was applied by Tenani¹⁵² in two cases. The method provides for the normal course of bile and pancreatic juice. This is accomplished by mobilizing the duodenum after the posterior gastro-enterostomy and resection of the pylorus; then the duodenal stump is sutured end-to-side to the efferent loop a short distance below the anastomosis. To mobilize the necessary portion of the duodenum requires releasing the whole of it down to the duodenorenal peritoneum. The latter is incised the entire length of the second part of the duodenum. This brings the duodenal stump away from the vena cava, and the pancreatic head and ducts come with it. To ensure the correct inclination to the duodenum, so that its contents will flow into the jejunum, the duodenum is lifted up and sutured to the stomach at a point beyond the mouth of the bile duct. The physiological course is said to be aided and in the cases of Tenani the method seems confirmed. The operation has considerable resemblance to the preceding one and to that of Vulliet¹⁵³ which he does for vicious circle (*vide supra*).

THE DUODENUM.

Duodenal Perforation. A duodenal perforation occurring after operation is always a very serious matter and the best method of treatment has hitherto been a gastro-enterostomy plus a pyloric exclusion; by this means the jejunum becomes utilizable for feeding purposes until the perforation closes. In a case of this kind occurring after cholecystectomy Einhorn¹⁵⁴ reports that the same happy result followed the use of a duodenal tube. The tube, when made to reach the jejunum, can accomplish all that the suggested operations can hope to do without subjecting the patient to a laparotomy in a rather critical period. This method of alimentation was first used to tide a patient over the emergency of an acute perforation by de Rosas.¹⁵⁴

At the army Base Hospital at Fox Hills (No. 41), Buckstein¹⁵⁵ found the method of duodenal alimentation of great value in the treatment of ulcer. From what is said it is probable that the method is not uncomfortable to the patient, as a rule, when properly handled.

¹⁵² Policlinico, Roma, 1919, xxvi, 185; Abstract, Journal of the American Medical Association.

¹⁵³ Medical Record, November 18, 1918.

¹⁵⁴ Revista Medica Cubana, December, 1916.

¹⁵⁵ Journal of the American Medical Association, 1919, lxxiii, 570.

Carcinoma of the Duodenum. Head¹⁵⁶ reports a case of primary carcinoma of the third portion of the duodenum in a man of seventy-four years. The location of the tumor in this man bears out the observations reported last year by Lichty¹⁵⁷ that carcinoma of the duodenum occurs very seldom in the ulcer-bearing area. The case of Head is unusual, also, in having the tumor in the third portion of the duodenum; most carcinomas grow in the neighborhood of the papilla. In reviewing the records of the Mayo Clinic, Judd¹⁵⁸ found 5 cases of primary carcinoma of the duodenum. In one of the cases the necropsy revealed a carcinoma extending up to the pylorus. In the second case there was a carcinoma of the pyloric end of the stomach, and beginning just beyond the pylorus, and independent of the first tumor was a malignant papilloma of considerable size. In the third case, the original tumor was presumably of the first portion of the duodenum, although the ampulla was obliterated; from the extent of the trouble it was difficult to determine at what point it originated. The fourth case was quite similar to the third. The fifth case was a large carcinoma originating in the first portion of the duodenum.

Duodenectomy. For more than ten years, attention in the experimental laboratory has been directed toward the duodenum with regard to its complete removal. Work has been done by Pfüger,¹⁵⁹ Minkowski,¹⁶⁰ Rosenberg,¹⁶¹ Ehrman,¹⁶² Lauwens,¹⁶³ Bickel,¹⁶⁴ Tiberti¹⁶⁵ and Matthews,¹⁶⁶ in America, in the last year or two, by C. A. and L. R. Dragstedt, McClintock and Chase,¹⁶⁷ Grey,¹⁶⁸ Moorehead and Landes,¹⁶⁹ and by Mann and Kawamura.¹⁷⁰

Minkowski¹⁶⁰ was the first to succeed and one of his animals lived for three weeks; in the operation the head and body of the pancreas had been removed with the duodenum. Matthews¹⁶⁷ also had some successes but in these fortune only followed when a portion of the duodenal mucosa was transplanted to a point in the jejunum some distance down. Outside of these the results of the experimental work was discouraging; the opinion gradually took root that the duodenum was essential to life, and the assumption seemed to be confirmed by the work of Matthews.

The operative removal of the duodenum is a most complicated procedure inasmuch as it involves a number of distinct steps each one of which, by itself, is formidable enough to present grave risks. The essentials to secure are (1) a normal passageway for the stomach contents

¹⁵⁶ The American Journal of the Medical Sciences, 1919, clvii, 182.

¹⁵⁷ Progressive Medicine, June, 1919.

¹⁵⁸ Journal of the American Medical Association, 1919, lxxii, 305.

¹⁵⁹ Arch. f. d. ges. Physiol., 1907, cxviii, 267.

¹⁶⁰ Arch. f. exper. Path., 1908, lviii, 271.

¹⁶¹ Arch. f. d. ges. Physiol., 1908, cxxd, 358.

¹⁶² Ibid., 1907, cxix, 295.

¹⁶³ Ibid., cxx, 623.

¹⁶⁴ Berl. klin. Wchnschr., 1909, xlv, 1201.

¹⁶⁵ Lo Sperimentale, 1908, lxii, 523.

¹⁶⁶ Journal of the American Medical Association, 1910, lv, 293.

¹⁶⁷ American Journal of Physiology, 1918, xlv, 584.

¹⁶⁸ Surgery, Gynecology and Obstetrics, 1919, xxviii, 36.

¹⁶⁹ Journal of the American Medical Association, 1919, lxxii, 1127.

¹⁷⁰ Ibid., lxxiii, 879.

into the jejunal loops; (2) an outlet for the bile into the intestine; (3) a similar outlet for the pancreatic secretions. In actual practice it was previously found impossible to secure all of these desiderata at one sitting and many workers were compelled to divide the operation into a number of stages, usually three in number. Up to the work of the American men, the procedures have entailed such an insult to the vital processes as to cause a fatality in almost every case and the opinion began to be expressed that, perhaps, the view that the duodenum was essential to life was erroneous, the danger really being the operative risk.

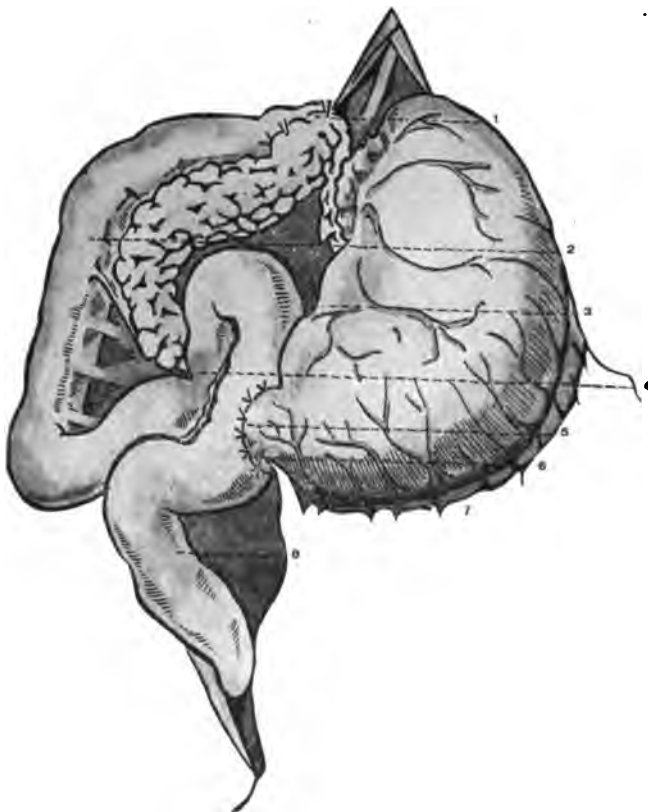


FIG. 46.—Completion of the first stage: 1, pancreas brought over closed end of duodenum; 2, duodenum; 3, lesser curvature; 4, duodenojejunal flexure; 5, anastomosis; 6, pylorus; 7, greater curvature; 7, jejunum. (Moorehead and Landes.)

In the past years communications from several Americans have reported some successes in animals in removing the duodenum. Two technics have been developed: A one-stage operation by Mann and Kawamura¹⁷⁰ and a many-stage operation by the Dragstedts, McClintock and Chase,¹⁶⁷ by Moorehead and Landes¹⁶⁹ and by Grey.¹⁶⁸

Briefly described, Mann and Kawamura's¹⁷⁰ operation consists of these four steps:

"1. The dissection of the duodenojejunal fold, the mesoduodenum and the lesser omentum, and the ligation of the bloodvessels supplying the upper jejunum and duodenum.

2. The separation of the pancreas from the duodenum and the isolation of the major pancreatic duct and the common bile duct, together with the minor pancreatic duct.



FIG. 47.—Transplantation of common bile duct and major pancreatic duct. 1, blind end duodenum; 2, common bile duct; 3, duodenum; 4, anastomosis; 5, pancreatic duct; 6, greater curvature; 7, jejunum; 8, papilla. (Moorehead and Landes.)

3. The removal of the entire duodenum, with a portion of the proximal jejunum and the distal pyloric portion of the stomach.

4. The implantation of the bile duct and the major and minor pancreatic ducts into the jejunum." The alimentary canal is "restored to correspond as nearly as possible to the normal state."

The method of Moorehead and Landes¹⁶⁹ will illustrate the many-stage operation. The essential steps are performed in three stages, as follows:

1. The first stage includes a dissection of the pyloroduodenal junction, with division through the pylorus; the removal of the mucosa from the duodenal stump for a short distance and the infolding of the peritoneal

cuff carrying with it the pancreas; the anastomosis of the jejunum to the open stump of the stomach as in the anterior Polya operation.

2. The second stage is done two weeks later and includes the dissection of the common bile duct and a portion of the duodenal wall containing the papilla and its implantation into the jejunum aboral to the gastro-jejunal anastomosis. The duct of Santorini is handled similarly; the minor duct is ligated and divided.

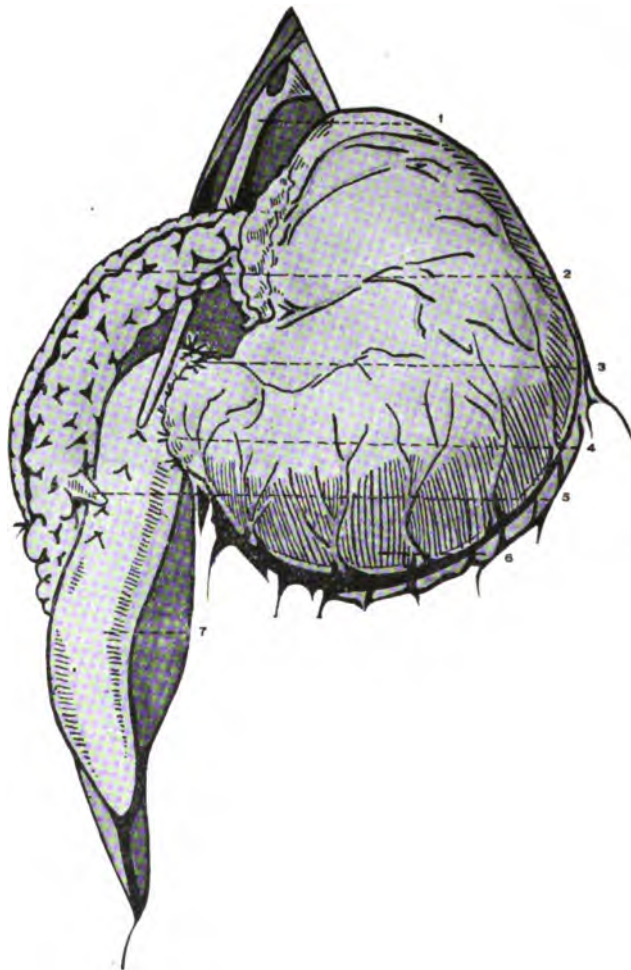


FIG. 48.—The complete duodenectomy. Final operation, January 9, 1919; photograph taken February 5; animal in perfect health; 1, common bile ducts; 2, remnant. of duodenum; 3, blind end of jejunum; 4, pylorus; 5, pancreatic duct; 6, greater curvature; 7, jejunum. (Moorehead and Landes.)

3. The third stage is done two weeks later. The duodenum is removed by opening the loop and scraping out the entire mucosa and muscularis with a sharp spoon; what is left is obliterated by an infolding stitch; below, the removal is completed by the usual method of resection.

The method of Moorehead and Landes¹⁶⁹ preserves the entire pancreas. Their method differs essentially from those of the other workers in the manner by which both the bile and pancreatic ducts are transplanted at one sitting and in the method of making the gastro-enterostomy.

In their later experiments, the Dragstedts, McClintock and Chase¹⁶⁷ devised and employed a one-stage operation.

The experiments of Grey,¹⁶⁸ as well, perhaps, as of the others, demonstrate that:

1. The major pancreatic duct can be successfully transplanted into the jejunum. Months later nothing abnormal could be made out in the microscopic or gross architecture of the pancreas, except a dilatation of the duct, most apparent in the third portion proximal to the intestine. The ostium and the bowel lumen remained patent.

2. The biliary and pancreatic juices may be successfully diverted into the upper jejunum. The withdrawal of these alkaline fluids profoundly affects the chemistry of duodenal digestion since ulcers frequently develop under these conditions. The subsequent resection of the duodenum eliminates this complication.

3. It is possible to resect the duodenum—every trace of mucosa and approximately all of the muscular coat—without embarrassing the vascular supply of the pancreas. This does away with the necessity of excising the greater portion of the gland, a recourse to which Minkowski was forced to turn when he sacrificed the pancreaticoduodenal vessels with the duodenum.

These experiments afford conclusive evidence that the duodenum is not essential to the life and comparative good health of a dog, at least for a period of nine and one-half months, provided the pancreas and liver continue actively to discharge their respective secretions into the gastro-intestinal tract. These experiments contradict the conclusion of Stassoff regarding the inability of the remaining part of the tract to compensate for the loss of the duodenum.

With their newly developed technic, Mann and Kawamura¹⁷⁰ removed the duodenum from the dog, cat, hog, goat and monkey. Careful studies on the dog did not reveal any noticeable changes following the duodenectomy. The animals remained in good condition. Examination of the blood showed it to be normal with regard to cell counts, hemoglobin, carbon dioxide combining power and hydrogen-ion concentration. The x-ray showed the course of a standard barium meal to be practically the same as in the normal dog. Experiments in the other species have been too recent to allow conclusions to be drawn, but it would seem that the removal of the duodenum in the hog is as innocuous as its removal in the dog. No data have been secured to show that the duodenum is of great importance in any of the species indicated. Future studies with particular reference to gastric secretion, etc., may give more positive results.

The Dragstedts, McClintock and Chase¹⁶⁷ had one dog which was kept alive for three months after complete removal of the pyloric part of the stomach, the entire duodenum and upper part of the jejunum. These workers conclude from their experiments that the mucosa of the removed

region of the digestive tract is not comparable to the adrenals or parathyroids in regard to function. The normal secretions of the duodenum or jejunum are not toxic. When bacteria are excluded from the lumen of the intestine, various pathological changes, even to complete occlusion of the blood supply to an isolated piece of intestine with resulting autolysis and reabsorption, can take place without the elaboration of sufficient toxic substances in the cells themselves, or in their secretions, to kill the animal. The duodenum does not excrete into the duodenal lumen any substance necessary for the life, or function, of the intestine lower down.

THE SMALL INTESTINE.

Intestinal Obstruction. Some studies of L. R. and C. R. Dragstedt, McClintock and Chase¹⁷¹ were undertaken to determine the *factors involved in the absorption of toxic material* from the intestine during an intestinal obstruction. It was found that if isolated intestinal loops were washed with water and ether previous to closure many animals survived the operation and never developed toxic symptoms; these loops, when subsequently removed and examined, contained large numbers of bacteria. Experiments made to determine whether the growth of bacteria and the production of the usual toxic substances in closed loops were prevented by the previous use of antiseptics, established the fact that this was impossible even in short loops. They indicate that the part played by the ether is not that of a bactericide and that it does not markedly inhibit the production of toxic materials in isolated loops of the intestine. The absorption of these toxic substances is for some reason prevented. It is possible for many times the lethal dose of these poisons to remain in closed loops of jejunum, or colon, without the production of toxic symptoms. Apparently simple astringents with no germicidal power are just as effective in preventing the symptoms of toxemia in dogs with closed intestinal loops as are the antiseptics. It was evidently the astringent properties of the ether and other chemicals, rather than their bactericidal properties which accounted for the results produced. It was also determined that the mucosa of the alimentary tract does not elaborate a secretion which could be disturbed by the conditions incident to an acute intestinal obstruction and which could account for the symptom complex of the latter condition. The substances responsible for the toxemia in acute intestinal obstruction are produced by the action of intestinal bacteria on proteins or their split products. An injury to the intestinal mucosa, particularly that resulting from disturbances of the blood supply to the intestine, greatly facilitates the absorption of these poisons.

The *eliminative function of the kidneys* during the intoxication of an acute intestinal obstruction was investigated by McQuarrie and Whipple.¹⁷² Associated with the intoxication of acute obstruction there exists a definite impairment of excretory function of the kidneys. The degree of functional depression corresponds roughly with the

¹⁷¹ Journal Experimental Medicine, 1919, xxx, 109.

¹⁷² Ibid., xxix, 397.

intensity of the clinical picture. The decrease in the urea ratio and in the capacity of the kidneys to excrete sodium chloride is more marked than is the percentage decrease of phenolsulphonephthalein elimination. The observed depression of function is readily demonstrated even when large amounts of fluid and urea, dye or salt are injected directly into the blood stream. The great increase of non-protein nitrogen in the blood usually observed in acute intestinal obstruction, which has, hitherto, been explained as being entirely due to an increased rate of protein catabolism, is due in part to retention of the products released from the injured cell protoplasm (cell protein).

There is in all probability a temporary injury of the kidney cells, since the most important extrarenal factors have been largely eliminated in the experiments; and McQuarrie and Whipple suggest that it is due to the direct action of the toxic substance on the renal epithelium. The actual demonstration of this renal injury is, perhaps, the strongest evidence so far obtained to prove the presence of an actual toxic substance in the blood during intestinal obstruction. This obscure disability of the kidneys during the height of the intoxication of acute ileus should always be considered in the clinical management of this condition and may serve as a guide to the degree of the intoxication.

The outstanding fact, presented by McQuarrie and Whipple,¹⁷³ is that the injection of the toxic proteose, obtained from the contents of the obstructed small intestine, causes a definite impairment of kidney function, which is similar in every way to that shown to accompany the intoxication of intestinal obstruction. There is no appreciable impairment of the renal function following the injection of a number of other proteose preparations from a variety of other sources. This study affords new evidence in favor of the view that the function of an organ may be profoundly disturbed for a time without any demonstrable anatomic lesion. The repair of this type of injury promptly follows the disappearance of the intoxication and is functionally and anatomically perfect.

Acute Gastro-Mesenteric Ileus. According to Condon,¹⁷⁴ the mechanism for the production of an acute gastromesenteric ileus is initiated by the small intestines gravitating into the pelvis, the resulting pull on the mesentery closing off the duodenum. In the belief that this, perhaps, could be prevented by filling the abdominal cavity with fluid, Condon did so during an operation for acute obstruction and the patient recovered. He realized that the same effect could have been accomplished by injecting fluid into the peritoneal cavity. Condon reports 8 cases of postoperative gastromesenteric ileus in which he followed this method of treatment. He employed 2500 c.c. of Ringer's solution; he added 500 c.c. of glucose solution in some and believes that the latter would be better for routine use to prevent acidosis.

Transduodenal Lavage. Transduodenal lavage is recommended by Jutte¹⁷⁵ for cases of ileus occurring in the postoperative period. An

¹⁷³ *Journal Experimental Medicine*, 1919, xxx, p. 421.

¹⁷⁴ *Annals of Surgery*, 1919, lxx, 107.

¹⁷⁵ *Journal of the American Medical Association*, 1919, lxxii, 929.

ordinary duodenal tube is inserted to just beyond the pylorus and a sufficient quantity of fluid is permitted to run into the upper intestine to produce a thorough flushing. The fluid must be slightly hypertonic so as to remain unabsorbed in its passage along the alimentary canal. Jutte reports concerning the use of this method in six cases of post-operative ileus, in one case of incessant hiccough and in one case of eclampsia; in all of these successful results were obtained. Jutte's first report appeared in 1912.

I am inclined to believe that the method would not be uniformly successful, especially when the ileus is associated with profuse vomiting of intestinal contents; certainly it must necessarily succeed only in cases in which there is no mechanical obstruction. It seems to me that most benefit should follow in the cases in which there is really only a paralytic distention; here the fluid introduced undoubtedly acts similarly to a saline cathartic, and any good effect which is obtained is very probably due to this action.

Traumatic Rupture of the Small Intestines. It used to be taught that the most fixed part of the intestine, being unable to escape a compressing force, was the part most frequently ruptured. In theory this seems probable, but in actual fact Stanley¹⁷⁶ shows the reverse to be true. The most fixed parts of the intestinal tract are the duodenum and those parts of the large intestine other than the cecum, the transverse and pelvic colon, and the rectum. Experience shows, however, that the most movable parts of the large gut—the cecum, the transverse colon, the pelvic colon—are the most frequently ruptured in the order given. The coil of intestine nearest the abdominal wall at the point struck, is usually the coil in which rupture takes place, and, insofar as the first few feet of the jejunum and the last few feet of the ileum before the ileocecal junction are usually in this position, they tend to be injured. The mechanism is simple. If the abdomen is struck above the umbilicus the force is transmitted to the first few feet of the jejunum; the mobility of this coil allows it to be pushed back until it is checked ultimately by the vertebral column; between the latter and the moving body it is crushed and ruptured. The frequency with which one finds a small tear in the posterior parietal peritoneum close to the summit of the vertebral column would suggest this mechanism; also the bruising and laceration at the site of tear suggests this. A parallel situation occurs at the ileocecal junction. There is no sure and invariable sign, or symptom, or group of symptoms or signs, which render the diagnosis certain. Occasionally a group of symptoms, such as rapid pulse, marked abdominal rigidity and extreme tenderness, with the history and with visible bruising and fracture of ribs, makes the rupture of the intestine almost a certain diagnosis; while, on the other hand, the absence of these signs and symptoms makes such a diagnosis improbable. The only two signs, which appear to Stanley to be of real use in diagnosis are cutaneous hyperesthesia and dulness in the left flank. The difficulty of diagnosis thus makes it clear that if there exists in the mind of the

¹⁷⁶ *Lancet*, London, 1919, ii, 726.

surgeon a suspicion that the intestine be ruptured, the right procedure is to open the abdomen and make sure, providing the patient can stand the added shock of the operation.

Tuberculous Colitis. According to Brown and Sampson,¹⁷⁷ tuberculous colitis can be diagnosed clinically with a considerable degree of certainty in the advanced cases. On the other hand, in the early and latent cases, when remedial measures may prove of avail, the clinical picture is not decisive. In all stages certain radiographic shadows, cast by the barium meal at the end of six, eighteen and twenty-four hours, determine definitely the presence of colonic ulcerations but the absence of such shadows does not absolutely exclude their presence. A roentgenographic picture, showing hypermotility and spasm, or filling defects in a patient with pulmonary tuberculosis, should lead to a definite diagnosis of colonic tuberculosis. Tuberculous colitis occurs far more frequently than has hitherto been supposed and must be excluded in all advanced cases and in any early case with any abdominal symptoms before submitting the case to radical treatment. No examination of a patient with pulmonary tuberculosis can, today, be considered complete without a roentgenological study of the intestine.

The use of calcium chloride in intestinal tuberculosis suggested itself to Saxtorph¹⁷⁸ because of D. Mandl's success with calcium salts in the treatment of intractable diarrhea. Satisfactory results were obtained in 3 of 6 cases. A 5 per cent. solution of calcium chloride is injected intravenously; no ill effects were noted.

Anthrax Enteritis. Brumbaugh¹⁷⁹ describes 2 cases in which abdominal symptoms complicated the manifestations of an anthrax pustule in the usual locations (face, etc.). The symptoms were great abdominal distention and distress, with fever, marked prostration and a rapidly fatal issue.

The postmortem findings included peritoneal exudates of clear or opalescent fluid (600 c.c. to 4½ quarts); and enlarged, inflamed, dark red, and edematous Peyer's patches, and follicles with elevated, irregular margins, necrotic bases and ulcers. Salient features were a marked involvement of the first portion of the duodenum; a selective action on lymphoid tissue analogous to typhoid; the accumulation of bacilli in the germ centers; the great intensity of the process; and penetration of the intestinal coat and involvement of the peritoneum producing a peritonitis. Anthrax bacilli were found in all of the lesions. Besides these there were the usual findings of an anthrax infection: The original pustule; an acute splenitis, a nephritis, and a mesenteric adenitis. The probable mode of transmission was, according to Brumbaugh, by contamination of the food with the fingers.

Carcinoma of the Small Intestine. Judd¹⁸⁰ reported a total of 19 instances of carcinoma of the small intestine from the records of the Mayo

¹⁷⁷ Journal of the American Medical Association, 1919, lxxiii, 77.

¹⁷⁸ Ugeskrift for Læger, Copenhagen, 1918, lxxx, 1763; Abstract, Journal of the American Medical Association.

¹⁷⁹ Journal of the American Medical Association, 1919, lxxii, 482.

¹⁸⁰ Ibid., 305.

clinic. During the same period there were 1689 cases of carcinoma of the stomach and 1822 cases of carcinoma of the large intestine. In the small gut there were 11 cases of carcinoma of the jejunum, 6 cases of carcinoma of the ileum and 2 cases of multiple carcinoma of the small intestine. According to Bevan,¹⁸¹ carcinoma of the small intestine gives, in general, much the same clinical picture as a pyloric obstruction; some points, however, are very different, such as vomiting of a large amount of material that has accumulated in the stomach and entire jejunal loop, and attacks of partial obstruction resembling greatly the partial obstructions in the large intestine. The diagnosis can be made with much more certainty by means of the roentgen ray than in any other way. Carcinoma of the small gut, when diagnosed early, gives a favorable prognosis.

Resection of the Intestine. Cannaday¹⁸² comments on the lengths of intestine—mostly small—which may be removed with safety. It is generally believed that half of the small intestine may be removed and the patient continue in a fair state of health. Under such conditions the necessarily extensive wastage of fats and albuminous materials must be made good by increasing these foodstuffs in the diet. A long table of reported cases is given by Cannaday and the lengths of intestine removed, which are noted, extend up to 540 cm.; of 68 such resections 9 died.

There seems to be a change of opinion as regards the method of anastomosing both small and large bowel. Although it is well recognized that side-to-side anastomosis is a much safer procedure, it is accompanied with certain physiological disadvantages which make it less desirable than an end-to-end union. Evidence presented by Senn and Reichel and Cannon and Murphy seems to show that peristalsis is impaired and that passage through a side-to-side stoma is, to a great extent, an overflow phenomenon. Opinion in certain quarters seems to be veering around to the desirability of end-to-end unions; adherence to this method has been emphasized by Lockhart-Mummery and Balfour.¹⁸³ Effort is being directed, as shown in the latest work, toward improving the operative technic so as to eliminate, if possible, the dangers, especially leakage, so frequently attendant to an end-to-end anastomosis.

In making any end-to-end intestinal anastomosis the great danger has always been the mesenteric border; here the suture was never as secure as at other points of the circumference and leakage followed. Shelton Horsley¹⁸⁴ calls attention to this triangular area at the mesenteric border and proposes to guard against infection—which to his mind is the source of the trouble—by adequately cleansing the bowel ends, especially at the danger point, with antiseptic solutions. Soresi,¹⁸⁵ too, makes a point of this area of danger in describing the method by which he unites the two stumps of gut; he makes use of an ingenious stitch which occludes

¹⁸¹ Journal of the American Medical Association, 1919, lxxii, 482, discussion.

¹⁸² Annals of Surgery, 1919, lxi, 425.

¹⁸³ Vide PROGRESSIVE MEDICINE, June, 1919.

¹⁸⁴ Transactions of Southern Surgical Association; Annals of Surgery, 1919, lxi, 25.

¹⁸⁵ Annals of Surgery, 1919, lxi, 613.

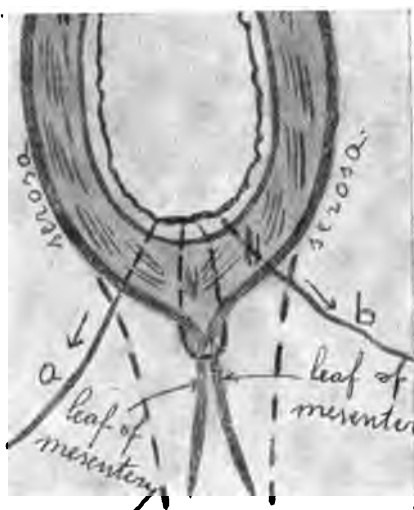
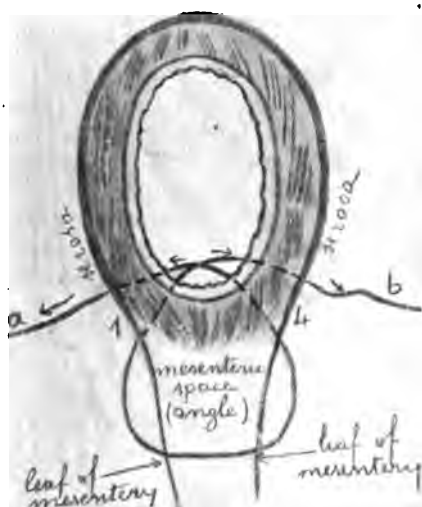
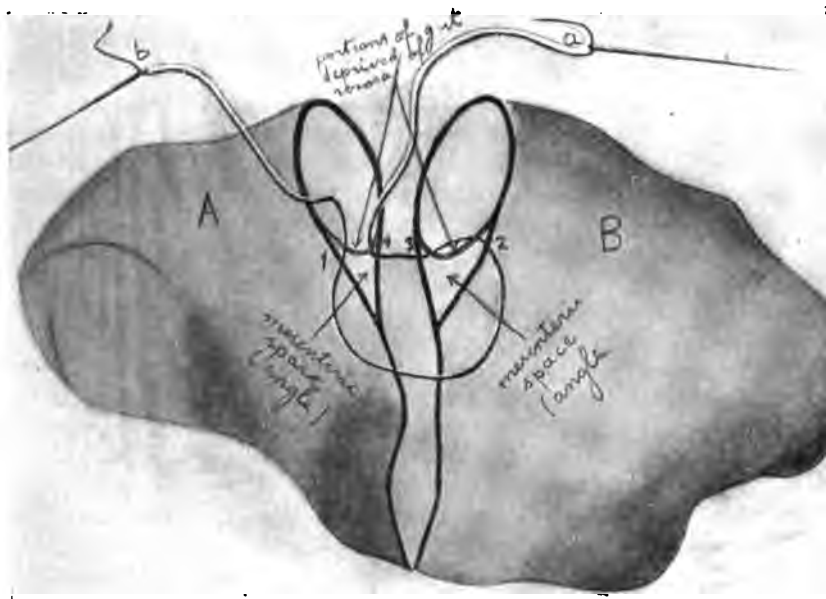


FIG. 49.—Mesenteric stitch. The illustrations show the three steps in which is divided the making and closing of the mesenteric stitch. The first step is made entirely with needle *a*, which starts at point 1 entering the lumen of the gut and coming out on the mesentery, traversing the acute angle made by the mesentery and the portion of the gut deprived of serosa. The same needle *a* then traverses the corresponding acute angle of stump *B* at 2, perforating first the mesentery and then entering the lumen, finally it traverses angle 3 perforating first the lumen and then the mesentery, finally it traverses angle 4 perforating first the mesentery and then entering the lumen. The second step consists in making needles *a* and *b* traverse the gut from the inside to the outside a little above of points of entrance of mesenteric stitch, needle *a* coming out above point 1 and needle *b* coming out above point 4. The third step consists in closing the mesenteric space without the use of knots, this is accomplished by pulling threads carried on needles *a* and *b*; dotted line shows former position of the two leaves of the mesentery before threads were pulled, that is, position identical with the position in serosa; note how serosa is well approximated at the mesenteric space, and mesenteric space is closed without undue tension, after threads have been pulled taut.

the triangular space and seals it off from infection. The method of introducing the stitch is described in the legend to the figure reproduced from Soresi's communication (Fig. 49). Other men have tried to attain the same purpose by rotating both stumps so that peritoneal surface of the one covers the triangular, aperitoneal surface of the other. Balfour's method of end-to-end suture between small and large bowel was described last year.

Gudin¹⁸⁶ describes in great detail a crusher clamp with thumb screw attachment for gastro-intestinal work, which, he says, absolutely prevents the escape of the intestinal contents, coaptates the mucosa accurately and does not crush the tissues enough to impair their vitality.

The Appendix. In analyzing 131 cases of acute disease of the appendix, Irwin¹⁸⁷ speaks of a large number as due to *acute obstructions in the appendix*. In the series there were 89 cases of acute appendicular obstruction, of which 10 showed obstruction only, 18 obstruction with varying amounts of gangrene; in 59 others the gangrene had led to rupture. In the obstructive cases it is Irwin's contention that the latter is the primary cause. Obstruction can be due to one of five causes: (1) Concretions (50 cases); (2) strictures (6 cases); (3) kinks (rare); (4) bands; (5) worms, fruit seeds and other foreign bodies.

Symmers and Greenberg¹⁸⁸ speak of a clinically recognizable syndrome referable to *lymphoid hyperplasia of the appendix*, attended by degenerative changes, or necrotic lesions, in the germinal areas, with, or without, sclerosis of the interstitial tissues of the submucosa. The syndrome is marked by repeated attacks of appendiceal colic occurring at intervals of days, weeks or months, which are not accompanied by noteworthy changes in pulse, temperature, or blood count. The picture is encountered most frequently in children or young adults and is probably peculiar to individuals afflicted with the status lymphaticus.

In a series of 500 cases at the Winterthur Hospital, Dubs¹⁸⁹ states that the proportion of cases of *acute appendicitis in persons over fifty years of age* was 5 per cent. This group includes 0.8 per cent. between sixty and seventy years and 0.4 per cent. between seventy and eighty years. In over 60 per cent. of these elderly patients the temperature was normal and the pulse rate normal, or very nearly so, even when the appendix showed a severe destructive lesion. Notwithstanding the slight impairment of the general health, there was pronounced local tenderness and extreme local rigidity of the abdominal wall over the appendix. In some of the cases abnormal local dulness and resistance were pronounced. In children the general symptoms dominate the picture while the reverse is the rule in the elderly. The mortality in the 25 cases was 12 per cent., a low rate which the writer attributes to the prompt operation.

Some new *blood findings in appendix conditions* are described by Friedman.¹⁹⁰ A transitional leukocytosis, or an increase in large

¹⁸⁶ Presse Médicale, Paris, 1919, xxvii, 133.

¹⁸⁷ Lancet, London, 1919, i, 98.

¹⁸⁸ Journal of the American Medical Association, 1919, lxxii, 468.

¹⁸⁹ Correspondenz-Blatt für Schweizer Aerzte, 1919, xlix, 172.

¹⁹⁰ American Journal of Medical Sciences, 1919, civiii, 545.

mononuclears and in transitionals, or an increase in either of these two, was found by Friedman in the blood of 87 per cent. of patients in whom corroborated evidence of chronic appendicitis was obtained. No such finding was present in cases with ulcer of the stomach, cholecystitis, renal stone or other organic abdominal condition. When other disease was associated with appendicitis, the changes indicated were found. A hyperleukocytosis, or a polynuclear leukocytosis, is, according to Friedman, superior to the *x-ray* as a diagnostic aid in the chronic cases. It often persists after the appendicectomy.

Spriggs¹⁹¹ values the *x-ray* for diagnostic purposes in cases of chronic appendicitis, and believes that with it he can recognize the diseased organ. In exceptional cases this is probably so, but, as a general rule, the statement will not meet with universal agreement. On the other hand Blanchod,¹⁹² quoting Roux, describes 9 cases, in 7 of which the *x-ray* revealed stones in the appendix. The symptoms frequently mimic that of stone in the ureter. In one case the stone in the appendix accounted for a sinus persisting and not healing.

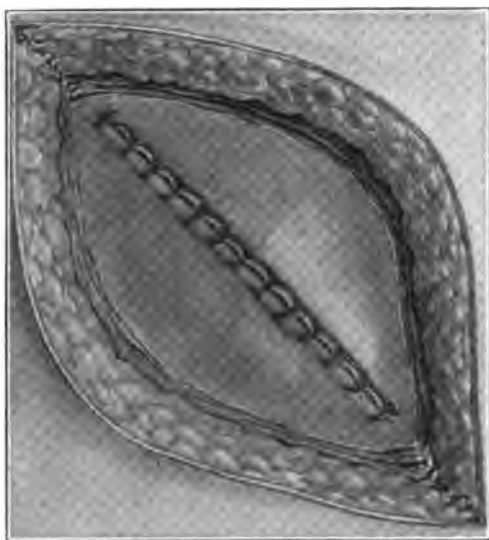


Fig. 50.—Peritoneal incision closed with chromic catgut. (Eisendrath.)

Apparently, Temoin¹⁹³ is one of the relatively few abroad who follow the American plan of operating as soon as possible after the diagnosis of acute appendicitis is made. The general French opinion is that after the first thirty-six hours a policy of waiting should be pursued until defervescence. Temoin, however, always operates no matter what the symptoms or stage of the attack. When the process is limited to the appendix, the percentage of recoveries is 100; in cases of perforation

¹⁹¹ Archives of Radiology and Electricity, London, 1919, xxiii, 301.

¹⁹² Revue Médicale de la Suisse Romande, 1918, xxviii, 599.

¹⁹³ Paris letter, Journal of the American Medical Association, 1919, lxxiii, 546.

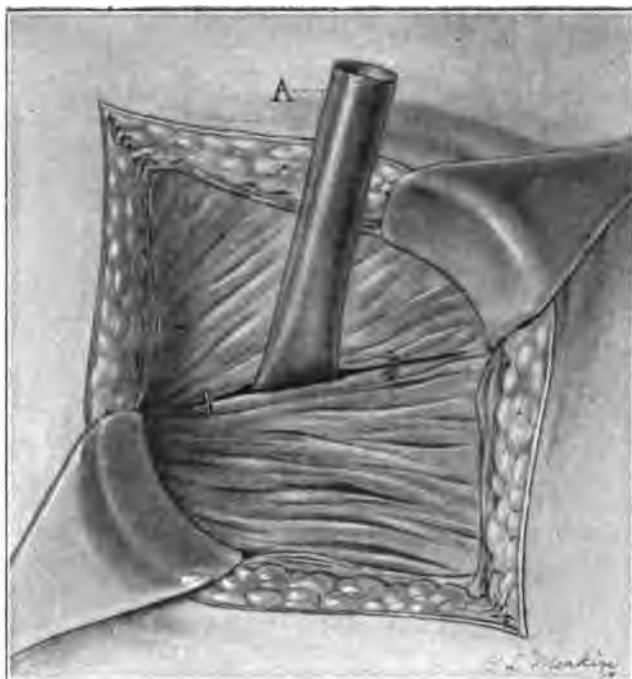


FIG. 51.—Soft rubber drain (A) inserted between edges of separated internal oblique fibers to drain subserous layer. (Eisendrath.)

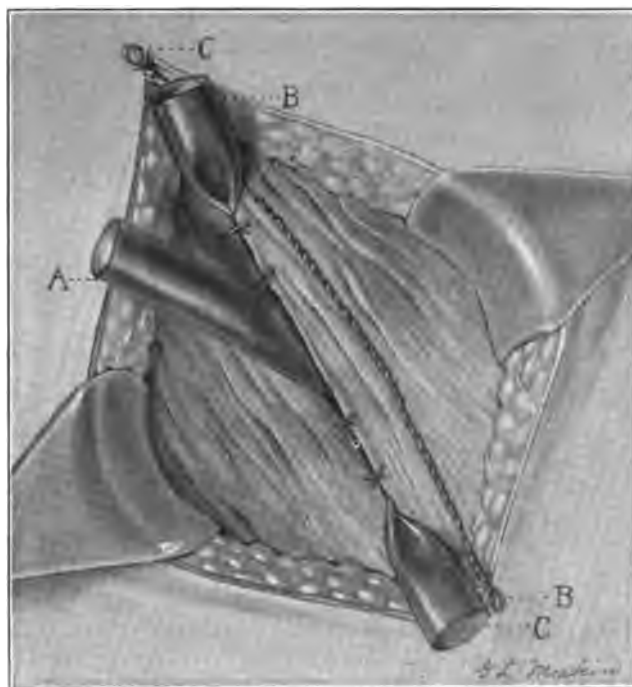


FIG. 52.—A, drain described in Fig. 51; B, soft rubber drain inserted between external and internal oblique muscles; C, silkworm-gut drain ready to be placed in subcutaneous layer. (Eisendrath.)

with peritonitis the mortality varies from 5 to 20 per cent.; this mortality is somewhat higher than is reported from our own States.

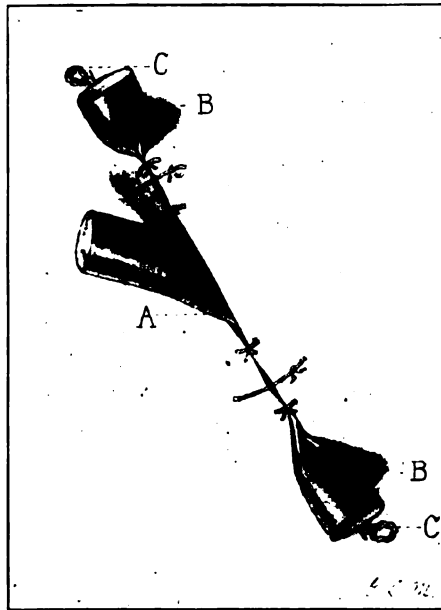


FIG. 53.—Skin incision closed, showing drains for various layers emerging, respectively through center and ends of original incision. (Compare with Figs. 50, 51, 52, and 54.) (Eisendrath.)

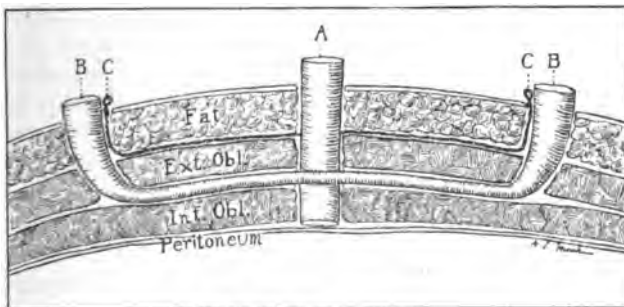


FIG. 54.—Sectional view with drains placed in various layers of abdominal wall. A, B and C as in preceding illustrations. (Eisendrath.)

Eisendrath¹⁹⁴ seeks to avoid, or to render as innocuous as possible, the infections of the abdominal wall which occur so frequently after operating for acute gangrenous, or perforated appendices with spreading peritonitis. Apparently his custom is to operate through a McBurney incision; at the close of the operation he institutes drainage of the various layers of the abdominal wall in the manner aptly illustrated in the figures taken from his communication. In that way he seeks to

¹⁹⁴ Journal of the American Medical Association, 1919, lxxiii, 1871.

obviate the infection entirely or to keep it from burrowing in the planes of the belly wall. The reviewer is of the opinion that much of this could be avoided by the use of a straight abdominal (Kammerer, right rectus) incision.

In a number of bad cases of appendicitis with peritonitis and secondary intestinal obstruction, Hageboeck and Kordner¹⁹⁶ observed, the wound having been left wide open, that one of the distended loops became gangrenous and ruptured, a free discharge of foul, greenish, intestinal content occurred, and recovery followed. This was purposely done in other cases which developed the same symptoms—distention, vomiting, obstipation—and was followed by similar good results.

THE LARGE INTESTINE.

Absorption from the Large Intestine. The apparent property of the intestine of passing dissolved substances in but one direction has been especially difficult of interpretation and has been the subject of much investigation. Recently experiments were made by Goldsmidt and Dayton¹⁹⁶ to determine this matter. They found that the colon is not characterized by a strictly one-sided permeability. There is a threshold of the colon below which chlorides diffuse from the blood stream into the intestinal contents. The blood content of chloride is a factor in determining the height of the threshold. The chlorides diffusing into distilled water, or very low concentrations of sodium chloride, in the colon have their origin in the blood. Hypertonic solutions of sodium chloride, which readily pass through the intestinal wall, attract fluid into the intestine above a certain threshold value; at the same time chloride passes in concentrated form into the blood. Solutions of sodium chloride above or below blood level come into a chloride partial pressure equilibrium with the blood; there is an attempt at total osmotic pressure equilibrium between the colon contents and the blood.

The colon behaves toward solutions of sodium sulphate essentially like a semipermeable membrane. Water is absorbed from hypotonic solutions and the concentration increases to blood level. With hypertonic solutions the volume increases and the concentration decreases. Solutions nearly isotonic with the blood show little change in volume; hence, there is a free passage of water with practically no diffusion of sulphate. Magnesium sulphate shows even less absorption from the colon than the sodium salt. This failure of absorption emphasizes the importance of the colon in saline catharsis.

When sodium sulphate, or magnesium sulphate, is added to solutions of sodium chloride and introduced into the colon, the concentration of chloride diminishes rapidly and the amount present approaches the zero mark. The concentration of sodium, or magnesium sulphate approaches a value of a concentration equi-osmotic with the blood.

Calcium lactate in increasing concentrations first accelerates, then inhibits, the absorption of chlorides from solutions of sodium chloride

¹⁹⁶ Journal of the American Medical Association, 1919, lxxii, 1066.

¹⁹⁶ American Journal of Physiology, 1919, 48.

in the colon. There is an indication that this action bears a relationship to the ratio of calcium to chlorine. The first stage of the action of calcium lactate on sodium chloride resembles that of sodium sulphate on the salt. The last stage presents the opposite effect to that of sodium sulphate.

Mills and Bird¹⁹⁷ point out that when more than four or five inches of tube are passed into the rectum it coils on itself and returns to the anus. This does not interfere with the passage of the injected fluid throughout the colon but suggests the uselessness of trying to introduce the tube further. In practise they have found it advisable to insert the tube and to first allow the escape of any gas; this does away with any pain which the introduction of fluid usually causes. Massage of the abdomen with the colon distended is often beneficial.

Rupture of the Large Intestine from Contusions. Soderland¹⁹⁸ discusses separately the clinical pictures and indications of intraperitoneal and retroperitoneal (extraperitoneal) subparietal rupture of the bowel; 16 cases of the former and 37 of the latter injury are included. The general symptoms, the degree of shock and the temperature are instructive when they confirm the local findings; otherwise they are not decisive. In the dubious cases hourly examinations are imperative; spontaneous pain, or an aggravation thereof, abdominal tenderness and the physical signs of fluid in the region of the contusion warn of incipient peritonitis. Repeated palpation of the rectum should be practised. The salient points of Soderland's technic in operating are that he does not wash out the belly, but simply mops out the contents grossly; that he sutures the perforation at once and does not drain. Over 72 per cent. of Soderland's cases recovered and the fatal cases were the severer cases from the very beginning.

With a retroperitoneal rupture, operative treatment is difficult to plan and carry out, the posterior wall being difficult to reach and still harder to suture. In most cases the resulting phlegmon spreads to the right and left sides and down along the psoas muscles into the pelvis. Death may follow from the diffuse peritonitis set up by the phlegmon, or result from the extensive retroperitoneal suppuration. The greatest danger is that, when the abdomen is open, the retroperitoneal rupture escape notice; unfortunately, this accident is not always avoidable. The most characteristic finding is a bulging of the posterior parietal peritoneum in the region of the duodenum. Suture of the retroperitoneal, is not as easy as that of an intraperitoneal tear; even when apparently well done, the suture line frequently gives way. Nevertheless, the attempt seems to be indicated in the cases with comparatively small tears, or—when the wall of the bowel has not been much damaged, or when the trauma is comparatively recent—of less than twelve hours' duration. Necropsy studies seem to indicate that the use of catgut or silk for suturing makes no difference as regards the holding of the suture line. In other cases a colostomy is indicated.

¹⁹⁷ Pennsylvania Medical Journal, 1919, xxiii, 346.

¹⁹⁸ Nordiskt Medicinskt Arkiv., Stockholm, 1919, li, 191; Abstract, Journal of the American Medical Association.

In a general way these injuries do not differ from the war injuries which I reviewed last year in *PROGRESSIVE MEDICINE*; the nature of the lesions are probably not as diverse as those which result from bullets or shell fragments, but their essential pathology is similar. Perhaps in view of the war experience one would attempt to prevent the phlegmon formations in the retroperitoneal tissues resulting from extraperitoneal ruptures; and, especially, in those which were demonstrable and were susceptible to suture, ample provision would be made for drainage in the event of the suture line giving way.

Intestinal Protozoal Infection. Among 450 civilians—men, women and children—examined by Matthews and Smith,¹⁹⁹ 7, or 1.5 per cent., were found to be carriers of *Endameba histolytica*. Among 1098 healthy recruits it was 5.6 per cent. The non-pathogenic intestinal protozoa (*E. Coli*, *Giardia* and *Chiolmastix*) are commonly distributed in the British population. Children become infected soon after the first year. Investigation of whole families, of which one member was known to be infected, showed infection to be more common in certain families in the general population.

Carles²⁰⁰ describes 8 different forms of *chronic intestinal disease common among returned soldiers*. Each requires special treatment. According to the special parasite involved, disturbances subside under emetin, sulphur, thymol, turpentine or male fern. In exceptional cases the enteritis may be a sequel of a paratyphoid or bacillary dysentery; in these the serocolic ulcerations require local treatment along with vaccines and serotherapy. In others test-meals reveal a functional digestive insufficiency and suggest the treatment. The enteritis may be due to abnormal fermentation or be an actual intestinal neurosis requiring prolonged local and general treatment.

Cotti²⁰¹ has treated 7 cases of acute rebellious *dysentery* by *appendicostomy* with subsequent daily flushing of the bowel with 1 to 1000 silver solution. The operations were done under spinal anesthesia. The usual measures had been previously tried without avail. This method of treatment has grown more and more in favor especially with the intractable cases. Most men prefer doing a cecostomy inasmuch as the appendix frequently does not lend itself sufficiently well for the indicated purpose in many of the patients; its lumen is frequently too small for subsequent handling. The cecostomy, on the other hand, yields a comfortably large opening, the manipulations are easily carried out—if necessary alone by the patient—and later the fistula can be easily closed. Taking it all in all the cecostomy seems to be the superior method.

A variety of solutions have been used for irrigation purposes, boric acid, quinine, silver, etc. Which of these works best in the individual case must be discovered by experiment.

Ameboid Tumors in the Large Intestine. Lasnier's²⁰² cases demonstrate the possibilities of amebic inflammatory tumors in the bowel. The

¹⁹⁹ *Annals of Tropical Medicine and Parasitology*, 1919, xii, 349 and 361.

²⁰⁰ *Presse Médicale*, 1919, xxvii, 67.

²⁰¹ *Bull. de la Soc. Méd. des Hôp.*, Paris, 1919, xliii, 119.

²⁰² *Anales de la Facultad de Medicina, Montevideo*, 1918, iii, 810.

possibility of such a manifestation of an amebic infection should always be borne in mind and treatment for amebiasis instituted before considering operative measures. The discovery of the ameba will often confirm the diagnosis, as the tumors would otherwise probably be ascribed to other causes, most often tuberculosis or carcinoma.

Unusual Diffuse Ulceration Due to a *Mycobacterium*. The extraordinary lesion reported by Crowdy²⁰³ was found during a postmortem examination of the body of a man who had died of a broncho-pneumonia complicating an empyema. The large gut showed an indolent ulceration most marked in the cecum and ascending colon. The dependent part of the cecum escaped to a marked degree but close to the valve was a large irregularly ulcerated area in which the mucous membrane was entirely lost except for a few very small irregular strands. In the ascending colon the surface of the mucosa had a honeycombed appearance, being made up of innumerable, small, irregular, shallow, pale ulcers with sloping necrotic margins separated by about an equal amount of degenerating mucosa. Toward the hepatic flexure the ulceration became less diffuse, and large isolated and irregularly outlined ulcers occurred, giving the mucous membrane a moth eaten appearance. These gradually diminished in number and disappeared near the splenic flexure. The lower end of the ileum also showed a few scattered irregular ulcers similar to those in the transverse colon and extending upwards for about 90 cm.

Gram-Weigert sections showed on the surface of the intestine the usual numbers and forms of bacilli and cocci; within the tissue, a large myco-bacillus of marked pleomorphism. A very common form was a long thick rod with rounded ends staining in alternately darker and lighter segments. This was found in the submucosa and in the islands of the mucosa. With it occurred coccoid bodies and transition forms to bacilli. A second also common form was an elongated, club-shaped, frequently curved or bent, slender organism carrying conidia at one pole often resembling an exclamation point in shape. The character of the threads and apparent lack of true branching point to a cladothrix.

Syphilitic Tumors of the Bowel. Bard²⁰⁴ does not agree with Fournier and others who deny that it is not possible to differentiate a syphilitic tumor from other tumors of the bowel. It has been his experience that in certain cases of smooth, regularly-shaped tumors, extremely movable, not tender, growing very slowly and inducing local stenosis but without notable impairment of the general health, a history of syphilis can be generally elicited and the tumor can be made to retrogress under specific treatment. Nothing is mentioned of a complement-fixation test.

Recto-Sigmoid Polyposis. Carnot, Friedel and Froussard²⁰⁵ report a case of generalized polyposis of the terminal bowel in which a cure was realized under local applications of magnesium chlorid. The patient had long had a chronic ulcerative colitis on the basis of which an extensive polyposis had developed sufficient to narrow the lumen to less than

²⁰³ Journal of Medical Research, 1919, xxxix, 338.

²⁰⁴ Arch. des Mal. de L'App. dig., Paris, 1919, x, 1.

²⁰⁵ Paris Médicale, 1919, ix, 495.

a finger's breadth. The rectosigmoid was cleansed every day with an enema and thereafter a thick agar mucilage of magnesium chloride was introduced; at first this contained 10 gm., and later 5 gm., per 250 gm. of vehicle. It was introduced by passing it above the stenosis with sound and syringe. The local application was borne easily and for a longer period each day up to ten hours. In less than three weeks the local condition was improved in that the ulcerations had healed, and in several months more the polyps had disappeared. Owing to anti-peristalsis the mixture is carried up and spread all over.

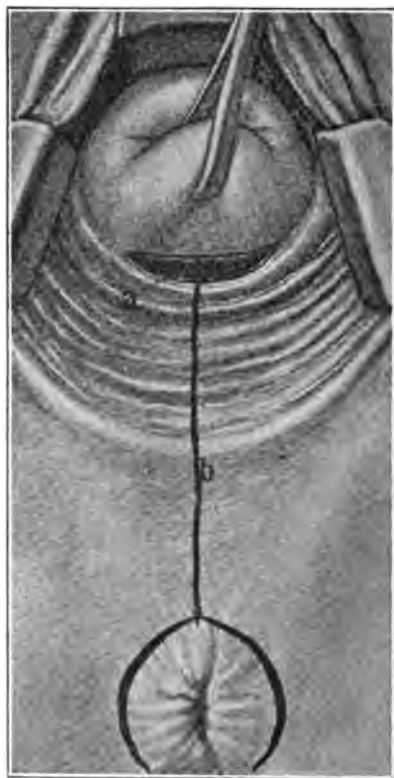


FIG. 55.—Long median incision from cervix to anus. (Darnall.)



FIG. 56.—Vaginal flaps laid back exposing rectum. (Darnall.)

A similar vehicle may prove useful in amebic dysentery when charged with emetin.

Prolapse of the Rectum. Morales²⁰⁶ had a patient in whom, following the excision of a cancerous growth from the rectum, a prolapse developed which kept recurring in spite of various palliative measures. Finally the tendency was controlled by inducing a cicatricial retraction as after a burn. The whole of the prolapsed mucosa was anesthetized

²⁰⁶ Siglio Medico, Madrid, 1918, lxx, 7; Abstract, Journal of the American Medical Association.



FIG. 57.—Rectum and growth lifted from its bed. (Darnall.)



FIG. 58.—Resection of rectum (upper section should show clamp applied). (Darnall.)

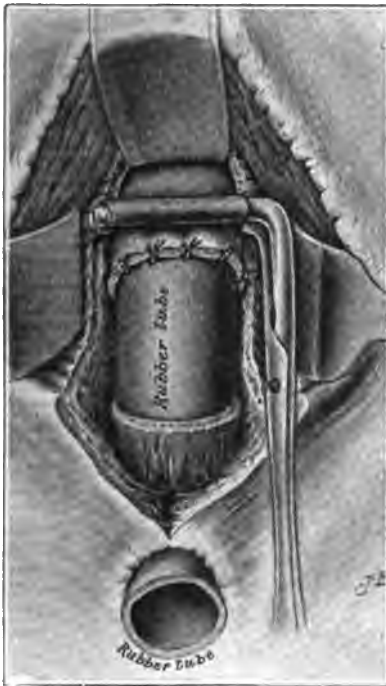


FIG. 59.—Tube sewn in upper segment emerging from anus. (Darnall.)



FIG. 60.—Anastomosis over tube completed. (Darnall.)

with 8 per cent. procain solution after which the actual cautery was applied to burn parallel stripes from above downwards, the latter close together. The procedure was repeated three times at intervals of six weeks. The outcome was a complete success.

Stricture of the Rectum. Yeomans²⁰⁷ reviews a series of 50 strictures of the rectum. Of these, 37, including 7 due to fistula formations, were of an inflammatory nature. Nearly half—24—were syphilitic; of these there were 8 males and 16 females; the Wassermann reaction was positive



FIG. 61.—Sutures placed for vaginal and perineal repair. (Darnall.)

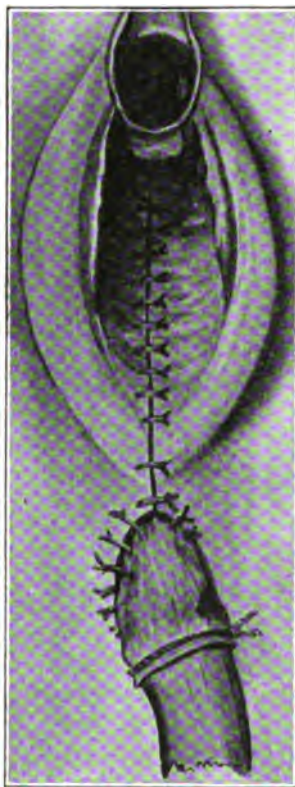


FIG. 62.—Vaginal excision of the rectum—the rectum sutured. A tube is tied into the divided end of the bowel. (Darnall.)

in 18 only—86 per cent. In 47 of the patients the stricture was within 10 cm. of the anus. Forty of the cases were observed for a long time: of these one patient with a tuberculous stricture died within three years; in 29 others there was improvement—that is the patients have been comfortable—in the remaining 10, 2 of whom are syphilitic, there was a cure.

The discussion at the annual meeting of the American Medical

²⁰⁷ Journal of the American Medical Association, 1919, lxxiii, 829.

Association brought out the fact that the Wassermann reaction frequently gave negative results in patients with syphilis; this seems to be especially

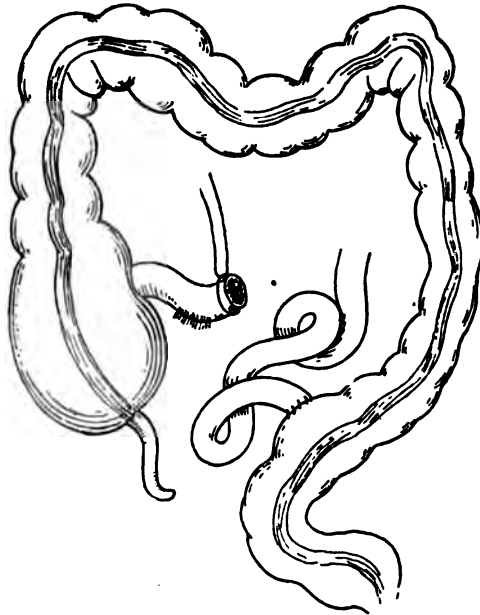


FIG. 63.—Diagram of end-to-side ileosigmoidostomy, with division of the ileum, the distal end being brought out into the wound. (Short.)

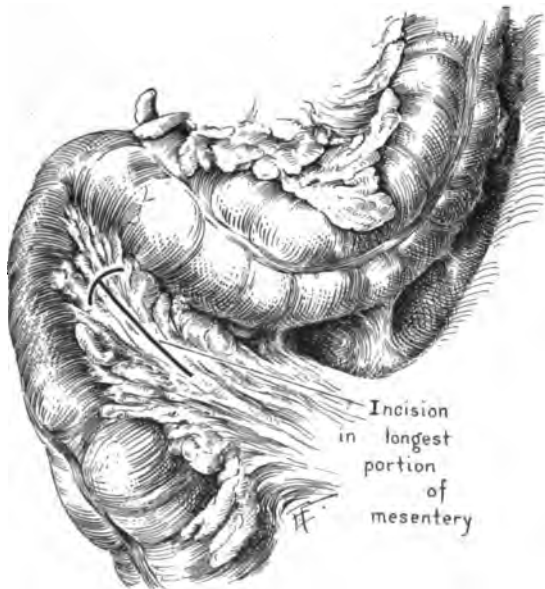


FIG. 64.—Near view of sigmoid flexure, showing the long mesentery in comparison with the short mesentery above it, and also the incision in the mesentery when the sigmoid flexure is used for making a colostomy. (Sistrunk.)

so in old syphilitics. In order to be certain of the test the practice seems to be to do the reaction on the spinal fluid.

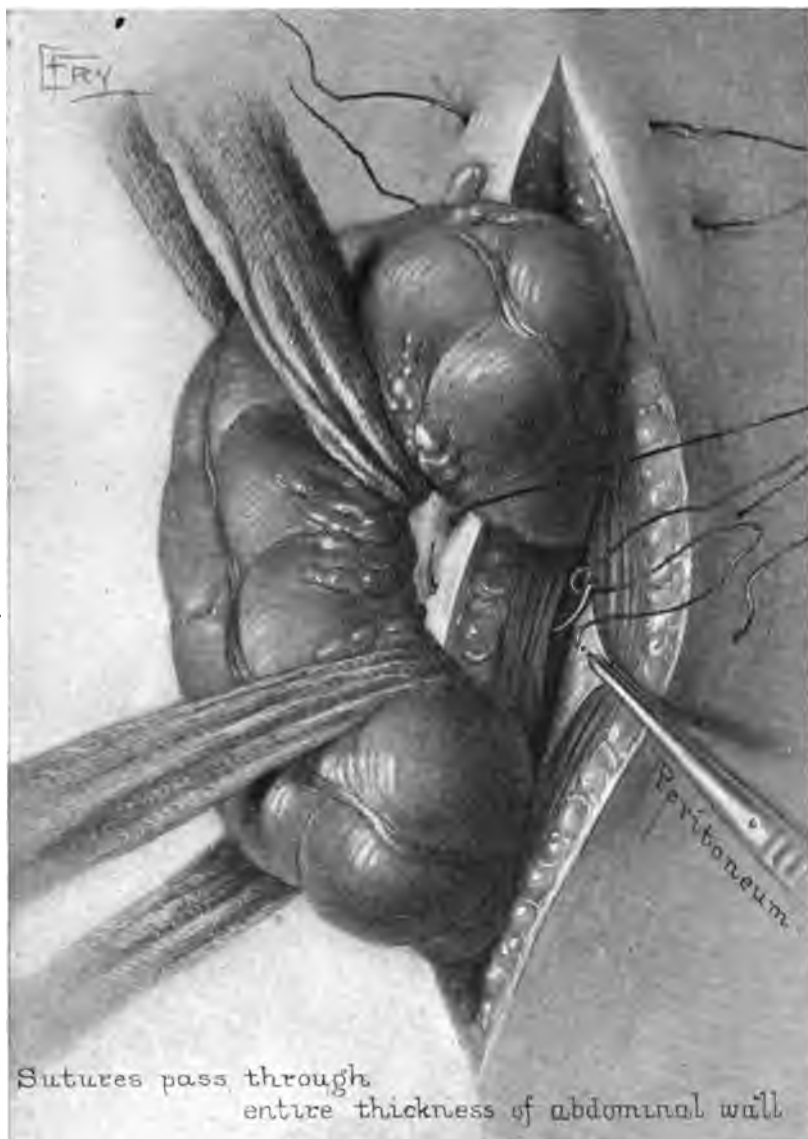


FIG. 65.—Edges of the opening in the mesentery of the sigmoid being held widely apart by gauze while a portion of abdominal wall is being closed through the opening. (Sistrunk.)

Darnall²⁰⁸ describes and emphasizes the ease of excising the rectum in women by the vaginal route whenever the conditions lend themselves

²⁰⁸ Journal of the American Medical Association, 1919, lxxii, 1670.

for the perineal removal of the tumor. The figures show the facility with which the parts can be reached. It seems that the vaginal route in women would be quite as appropriate as part of the combined, or two-stage operations which are prevalent now.



FIG. 66.—Unopened loop of bowel brought out for colostomy after the abdominal incision has been completely closed.

CARCINOMA OF THE COLON. Desmarest²⁰⁹ makes use of a left supra-umbilical incision for removal of cancers of the left colon; unusually ample access to the splenic angle of the colon and also to the left portion of the transverse colon is afforded. Section of the phreo-colic ligament permits easy and complete mobilization of the transverse descending angle of the gut. If the bowel is completely obstructed, Desmarest

²⁰⁹ *Presse Médicale*, 1919, xxvii, 363.

advises that the feces be diverted through an ample cecostomy in which the mucosa is sutured to the skin.

When carcinoma of the colon is complicated by an acute obstruction, Short²¹⁰ tides the patient over the emergency with the following technic: (1) A median laparotomy (to verify diagnosis); (2) division of ileum about 4 inches from the valve; (3) incision 2 or 3 inches deep into mesentery of the ileum; hemostasis; (4) Trendelenburg posture; (5) proximal



FIG. 67.—Ends of the bowel after it has been completely cut across. (Sistrunk.)

end of ileum united by end-to-side anastomosis with Murphy button to pelvic colon as high as possible without going too near the tumor; (6) closure of the abdomen in layers; distal stump of ileum, with catgut ligature tied around the end, brought out in middle of wound. The technic is similar to that described by Ochsner in 1917.

The *technic employed for making permanent colostomies* at the Mayo

²¹⁰ British Journal of Surgery, 1919, vi, 382.

clinic is described by Sistrunk.²¹¹ The procedure is done somewhat after the method of Mixter. Through a straight incision placed below and about one inch to the left of the umbilicus a loop of sigmoid is withdrawn. An opening is made in the mesentery and the abdominal wall is sutured across through the opening. A glass rod is passed through above the skin to aid later in cutting through. The opening in the bowel can be made within twenty-four or forty-eight hours. As a rule gas can be passed through the knuckle lying on the abdominal wall easily and the opening need not be made for five or six days.

Carcinoma of the Rectum. Back²¹² claims that only 30 per cent. of the rectal carcinomas admit of radical operation when first seen. He believes that, when radical operation is not permissible, a hypogastric colostomy should be done at once. Radical operations, which aim to retain the anal canal, are, pathologically, unsound. The only correct radical operations are (1) a two-stage operation—colostomy and excision by the perineal route; and (2) the combined abdomino-perineal operation. The former is better.

THE LIVER.

Functional Capacity of the Liver. Kinberg²¹³ reports the results of much personal research on the elimination of amino-acids and ammonia in health and with a diseased liver. He tested the functional capacity further by the ingestion of gelatin, instead of glycocoll which has previously been recommended for the purpose. The patient is put on a constant diet with low nitrogen content for several days and thereafter 50 gm. of gelatin in hot chocolate are taken on the empty stomach. Kinberg did not find any increase in the output of the amino-acids with liver disease except after the gelatin test; then the output increased with serious pathologic conditions of the liver, as with cirrhosis, but not with mere catarrhal jaundice or congestion of the liver, and not in health. The output of ammonia was always found higher with liver disease than in health, both absolutely and relatively.

Influence of Internal Secretions on the Formation of Bile. Downs and Eddy²¹⁴ found that the amount of bile secreted is increased by secretin and decreased by adrenalin and by mammary, orchic, ovarian, pancreatic and thymic gland substances. The secretion of bile is not affected in a constant or definite manner by the substance of the spleen and thyroid.

Oriental Constricted Liver. Oshima²¹⁵ investigated 16 cases of the so-called oriental constricted ("Schnürleber") liver and found that the course of the sulcus in the organ coincides with that of a vessel in the

²¹¹ Transactions of Southern Surgical Association, Journal of the American Medical Association, 1919, lxxii, 219.

²¹² Lancet, London, 1919, ii, 421.

²¹³ Hygiea, Stockholm, 1919, lxxxi, 689; Abstract, Journal of the American Medical Association.

²¹⁴ American Journal of Physiology, 1919, xlvi, 192.

²¹⁵ Sei-I-Kwai Medical Journal, Tokyo, 1919, xxxvii, 10; Abstract, Journal of the American Medical Association.

diaphragm. He is of the opinion that the fixation of the liver by the suspensory ligament and the pressure of the Japanese woman's belt make the longitudinal sulcus in the liver immovable; moreover, the liver is compressed by the diaphragm from above and, because of the manner in which the Japanese customarily sit, from below. As the liver tissues begin to show the effects of age, there is a natural tendency to a folding in of the superior surface of the liver corresponding to the sulcus sagittalis in the inferior surface.

Amebic Liver Disease. In a large proportion of the cases of amebic disease of the liver, which Ravaut and Charpin²¹⁶ have recently had to treat in soldiers, there was no history of any preceding manifestation of an amebic infection. On the other hand, in most of Cros and de Teyssier's²¹⁷ cases the dysentery phase of the infection had been passed with little, or no, extraordinary discomfort. Ravaut and Charpin suggest the possibility that the ameba induces a different clinical picture in a temperate climate than in the tropics; no other assumption seems sufficiently explanatory. The men complained merely of pain in the liver region; sometimes this involved the epigastrium, the hypochondria and the base of the chest. The liver was enlarged but there were tender points in some cases only. The fever curve was variable; sometimes after the pus had collected there was no further fever. Cros and de Teyssier advise treatment in every case of persisting pain in the liver in regions where amebiasis is endemic, regardless of whether there have been symptoms suggesting dysentery; under such conditions every tendency to diarrhea is suspicious of amebic infection. Their routine treatment is to administer emetine by daily subcutaneous injections of 0.04 gm. for four or six days; then at longer intervals, reducing the dose to 0.02 gm. If this fails the emetine is injected directly into the abscess cavity after it has been emptied by puncture. Ravaut and Charpin²¹⁷ have been most successful with a combination of emetine and some arsphenamin preparation: the dosage, employed by them in a typical case, was 10 intravenous injections of French neo-arsphenamin at six day intervals, and 18 injections of from 0.04 gm. to 0.08 gm. emetine—all in forty days.

Acute Yellow Atrophy of the Liver in Syphilis. In an experience of over 5000 postmortem examinations performed since 1898, McDonald²¹⁸ has had one case of acute yellow atrophy of the liver in syphilis. Then, in the course of a few months, 5 cases were seen all of which occurred in syphilitic subjects in the course of, or subsequent to, treatment by salvarsan preparations and mercury. In practically all of the cases a full course of intravenous injections of salvarsan had been given, coupled with the usual intramuscular injections of mercury. In each case the diagnosis of syphilis had been confirmed by the Wasserman test. These cases were not of undue severity, and showed no special symptom of importance until the onset of jaundice was noticed, at first without any special disturbance and suggesting nothing more than an ordinary

²¹⁶ *Presse Médicale*, 1919, xxvii, 65.

²¹⁷ *Arch. de Méd. et de Phar. Mil.*, 1917, lxviii, 531.

²¹⁸ *British Medical Journal*, 1918, i, 76.

catarrhal jaundice. At a varying period thereafter of from two to eight days, however, acute symptoms developed suddenly. These were ushered in by a period of wild excitement and increased icterus, with hematemesis. The patients rapidly passed into a condition of deep coma, and death occurred at periods of from one to four days from the onset of the acute symptoms. The urine was markedly bile stained, and in each patient it contained tyrosin; in some, leucin was also demonstrated. Diminution in the size of the liver could be demonstrated during life.

Etiology of Cirrhosis of the Liver. Urrutia,²¹⁹ in looking over the records of 60 cases of cirrhosis of the liver in adults, found abuse of alcohol in 35 per cent., but in 39 patients alcohol could not possibly be incriminated; these findings corroborate the belief which has been spreading in the last years. In 15 per cent. there was a history of a chronic malarial infection. In 4 women no cause for the cirrhosis could be detected. In 5 per cent. of the total number, syphilis may possibly have furnished a contribution, although one of the 12 patients in this group was a habitual drinker. Banti's cirrhosis, according to Urrutia, seems, anatomically, to be identical with Laennec's cirrhosis; of the 7 cases of this kind, none had a history of abuse of alcohol.

Shonberg found cirrhosis of the liver to be quite common in the tuberculous cadavers at Basel. In some cases no evidence of tuberculosis could be found elsewhere; but the discovery of tubercles in the cirrhotic liver seemed to confirm the diagnosis. Similar liver findings were encountered also in cattle; in the animals they formed the connecting link between the experimentally induced cirrhotic processes in the livers of tuberculous guinea-pigs and the spontaneous cirrhosis of the liver in man. Hossly found cirrhosis of the liver in Greenland where there is no liquor drinking but where tuberculosis is very prevalent. The association of cirrhotic changes in tuberculous subjects is not extraordinary as a certain amount of fibrous tissue change is quite to be expected in the presence of tuberculous lesions; it seems quite a different matter to assume any etiological relationship between tuberculous infections and the forms of Laennec's cirrhosis. (Reviewer.)

Some studies on *cirrhosis of the liver following the intraportal injection of toxic substances* are communicated by Ogata.²²⁰ In the cases in which he injected alcohol into the portal and mesenteric veins repeatedly, there were seen marked cirrhotic changes in the interlobular spaces with, very often, newly formed bile ducts; the latter were especially marked in one case: in addition in two other cases there was also a marked round-cell infiltration with increase of connective tissue in the central portions of the lobules. Various pronounced degenerative changes of the liver parenchyma were also seen. The cirrhosis was not, morphologically, the same as in Laennec's cirrhosis of the liver. On the other hand, in the series of cases in which he injected alcohol repeatedly into the ear vein, Ogata observed but slight changes in the interlobular spaces and in the parenchyma of the liver. The difference observed in the two groups of

²¹⁹ Siglio Medico, Madrid, 1918, lxxv, 1035.

²²⁰ Journal of Medical Research, 1919, xl, 103.

experiments may possibly be due to the difference in concentration of the alcohol as it arrives in the portal area.

Repeated injections of extract of cigar tobacco into the portal and mesenteric veins have some toxic effects on the liver: Various changes in the liver parenchyma, with remarkably fatty change in two cases, were noted, but only a slight infiltration of round-cells with, usually, no accompanying increase of connective tissue in the interlobular spaces. The cases in which extract of cigar tobacco were repeatedly injected into the ear vein showed almost analogous changes though they were not quite so marked. The difference, again, may be a difference in concentration. The changes of liver structure, which resulted in the experiments with nicotine, were quite different from those usually seen in a Laennec's cirrhosis.

After the repeated injections of sterilized human tubercle bacilli into the portal and mesenteric veins of the rabbit, there followed marked changes resembling tuberculous lesions which, in turn, were followed by an increase of connective tissue chiefly in the interlobular spaces; some toxic effects on the parenchyma of the liver were also discernible. The experiments seem to indicate that cirrhotic changes in the liver may be produced by killed tubercle bacilli and their toxic products without the presence of living bacilli and that there may be some relation between tuberculosis, especially of the peritoneum and intestine and cirrhosis of the liver.

The series of animals in which an emulsion of killed colon bacilli were injected into the portal and mesenteric veins showed marked cell infiltration and some proliferation of the connective tissue in the interlobular spaces and some toxic effects on the parenchyma of the liver. It seems evident, then, that sterilized colon bacilli and their toxic products may, also, produce cirrhotic changes in the liver, though not to the same degree as is customarily seen in Laennec's cirrhosis.

In spite of the marked cirrhotic changes of the liver in some cases, no ascites was seen by Ogata in any of the animals experimented upon; it is probably very difficult to produce such an effusion under the experimental conditions indicated.

The extent of the changes in the liver is not always proportional to the frequency of the injections of toxic substances into the portal, or mesenteric, veins in the same, or in different, rabbits. Under the latter proviso the condition may depend more or less upon the individuality of the rabbits, but the results obtained may be more reasonably explained by the observation that the cells which were once injured by the toxic substances are regenerated and then develop an increased resistance to these substances.

These studies of Ogata are very valuable and most interesting. The essential lesson to be learned, perhaps, is that the cirrhotic changes, which one sees so frequently in livers, seem to be reflections of the organism's response to various traumata. In the experimental conditions the traumata are of a chemical nature, some resulting from the biological activity of various bacteria; the fact that the response in the liver shows a variable intensity is quite to be expected and probably

holds a mathematical relationship with the virulence of the poisonous products used in the experiments. In human pathology the initial traumata are probably always of a chemical nature and the poisonous bodies, whether resulting from bacterial activity or from a physiological, or pathological, metabolism, are derived most commonly from the areas drained by the portal system. The degree of the cirrhotic changes, the relative distribution within the liver capsule, and the rapidity with which the pathological picture develops, probably holds intimate relationships with the kind of the poisonous body at work and with the amount of it being constantly delivered in the liver area.

Elsworth and Colp²²¹ have collected and classified the late results of OMENTOPEXY FOR CIRRHOSIS OF THE LIVER. There were 2 cases under twenty years of age, both of which died after operation. Of the patients between twenty and fifty years, 16 per cent. died; from fifty to sixty years, 60 per cent. died; and over sixty years of age every patient died after operation. Of 14 cases, which showed much undernourishment and emaciation with thin reddened nostrils and prominent venules, 43 per cent. died after operation. Of 8 cases with definite cardiac disease—auricular fibrillation, myocarditis, relative mitral insufficiency—70 per cent. died. In those, in which dilatation of the deep epigastric and internal mammary veins indicated the establishment of compensatory circulation, 50 per cent. died shortly after operation. This might show that where the portal channels were so obstructed as to force hypertrophy of the collateral circulation, operative interference was of little value, the functional liver tissue being inadequate for the demands.

The slower the effusion develops into the peritoneal cavity, the better the prognosis: Thus, of 2 cases with ascites within three months, 2 died; of 4 cases with ascites within six months, 3 died; of 7 cases with ascites within one year, none died.

According to the number of tapplings done for ascites: In 4 cases tapped 15 to 20 times, the mortality was 75 per cent.; in 5 cases tapped 6 to 10 times, the mortality was 50 per cent.; in 14 cases tapped 1 to 5 times, the mortality was 30 per cent.

Local anesthesia for the operations gave a mortality of 29 per cent.; general anesthesia, a mortality of 37 per cent.

Prior to 1908 the cases in the series studied by Elsworth and Colp were operated upon according to the method of Morison (as proposed by Talma): The procedure consists of suturing the omentum to the posterior surface of the parietal peritoneum and of vigorously rubbing the surfaces of the liver and spleen; this is productive of much shock. After 1908 the method of Schiassi, of Bologna, with some modifications, was employed: The operation includes a suture of the omentum to the posterior surface of the parietal peritoneum and the insertion, and fastening, of a tongue of the former into the preperitoneal space.

Drainage was omitted in the later cases; a reaccumulation of fluid was removed by tapping forty-eight hours later. Drainage seems to multiply the ultimate dangers. In Greenough's cases 20 were drained, with a

²²¹ Surgery, Gynecology and Obstetrics, 1919, xxviii, 309.

50 per cent. mortality, and 34 were not drained, with a 14 per cent. mortality.

In carefully selected cases, Elsworth and Colp believe the operation of omentopexy to be of distinct benefit.

Method of Hemostasis in Resection of the Liver. While removing a tumor of the liver, Freeman²²² controlled the hemorrhage by tying off the part to be removed with two long pieces of fascia lata used like two pieces of tape. These strips were first pulled directly through the substance of the liver from behind forwards with a pair of long alligator forceps and their respective ends tied very tightly around the organ to either side. The growth was then cut away well within healthy liver tissue without the slightest difficulty, or bleeding, in spite of the great thickness of the hepatic stump.

Ascariasis in Gall-bladder Disease. Aviles points out that an individual who is seized with hepatic colic-like pain, accompanied with vomiting of ascarides lumbricoides, has the syndrome necessary for suspecting that the case is one of migration of the parasites into the biliary duct system; and unless the symptoms gradually subside, surgical intervention is indicated. Anthelmintic remedies must be administered both in a prophylactic way and to prevent new serious complications.

Functional Stomach Disturbances with Cholelithiasis. Wessel's²²³ examinations show that hypochylia, or achylia, is very frequent with cholelithiasis, and is persistent. Gastritis probably develop in time, rendering the achylia irreparable. The gastric condition seems to be a reflex phenomenon and it is Wessel's impression that an achylia is the rule after cholecystectomy. In 41 cases in which the stomach secretions were investigated in cases of infectious processes in the biliary passages, hypochylia or achylia was the rule also. Wessel believes the question of the possibility of a reflex achylia to have been definitely settled by this investigation. Prompt operation on the biliary passages with conservation of the gall-bladder before irreparable lesions are installed, would, therefore, be advisable. Rovsing has long disputed the tendency to cholecystectomies and these researches of Wessel seem to show that this operation may leave the patient with a permanent affection. Achylia, according to these studies, is an indication for an operation in gall-stone conditions, not only to ward off an irreparable gastritis, but because the bile passages seem to become infected more readily when the gastric secretion is below par.

Chronic Pericholecystitis with Marked Gastric Symptoms. Churchman²²⁴ speaks of thick, firm, extensive adhesions between the gall-bladder and the neighboring parts of the stomach, the liver or the colon. He is not certain whether these represent old gall-bladder inflammations attendant to the passage of a stone. The manifestations for which operation is done are almost always solely referred to the stomach. Inasmuch as the adhesions represent the end result of some previous condition the

²²² Colorado Medicine, 1919, xvi, 111.

²²³ Hospitalstidende, Copenhagen, 1919, 72. Abstract, Journal of the American Medical Association.

²²⁴ Journal of the American Medical Association, 1919, lxxii, 17.

determination of the inciting condition is purely speculative. Nevertheless cases are reported by Churchman in which cholecystectomy and appendectomy were done with relief of the symptoms.

Cholecystitis. ETIOLOGY OF CHOLECYSTITIS. By making cultures of emulsified tissue of the gall-bladder wall after the Rosenow technic (or of the adjacent lymph nodes) Brown²²⁶ found streptococci to be the chief organism associated with cholecystitis. The direct etiologic relationship of the streptococci seems to Brown to be established by their presence, often in numbers proportionate to the degree of the gross and microscopic changes, by their having elective affinities for the gall-bladders of animals and by the specific agglutinating power of the sera of the patients from whom isolated. The elective affinity of the gall-bladder of animals for the strains from the tonsils indicated to Brown rather strongly that cholecystitis is commonly a blood-borne infection from a focal source.

CHOLECYSTITIS FOLLOWING TYPHOID FEVER IN CHILDREN is not very common. According to H. C. Deaver²²⁶ the clinical picture is one of profound shock and closely resembles that of an obstruction, or a perforation, or of a high ruptured appendix. Perforation is very common; operation is always urgently necessary.

Cholecystectomy. Masson²²⁷ prefers to remove the gall-bladder from below upward. Good exposure is necessary for this. The abdominal incision extends from the midline at the xiphoid to a point 2 inches external to the umbilicus. If it is necessary to remove the appendix also, the incision is prolonged downward. This is all that is needed even when the right lobe of the liver cannot be rotated. In exceptional cases additional exposure is gained by inserting a pack (four inches by three feet) between the posterior superior surface of the right lobe of the liver and the diaphragm. In this manner the liver is made to descend slightly, the concave visceral surface is flattened somewhat, and the hilum of the liver is made more accessible. The insertion of this pack is an easy matter and, if carefully placed, it can in no way injure either the liver or the diaphragm. While with an ordinary abdominal retractor the second assistant retracts the right costal margin upward and outward, and while with a long shoe-horn retractor the first assistant gently retracts the liver in the opposite direction, the operator can place the pack in position using a long forceps to carry the gauze along the shoe-horn retractor. Mason feels this has aided matters.

Magie²²⁸ is in favor of saving the gall-bladder as often as possible. One of the reasons advanced for this is that Magie has never seen an empty gall-bladder. Magie feels that the gall-bladder has much to do with keeping up and regulating the pressure in the bile ducts and liver, because, when the gall-bladder is removed, the stump of the cystic duct and the hepatic and common ducts all dilate. On the other hand, Mann and Foster, in a number of very interesting experiments, were able to show in animals that the secretory pressure bears no relation to the presence

²²⁶ Archives of Internal Medicine, 1919, xxiii, 185.

²²⁶ Annals of Surgery, 1919, lxix, 534.

²²⁸ Surgery, Gynecology and Obstetrics, 1919, xxvii, 402.

²²⁷ Ibid., 422.

or absence of the gall-bladder. However that may be, a consideration of the many classes of diseased gall-bladders, which Magie enumerates and in which he acknowledges that cholecystectomy is indicated, would make it appear that in actual practice he would not have many opportunities for doing a conservative operation on the organ.

Richter and Buchbinder²²⁹ are in the habit of suturing the ducts whenever exploration of them is indicated; the suturing is done at the close of whatever procedure is necessary to correct any abnormality in the duct. They employ the finest needles and suture material obtainable. Whenever possible, a double layer is inserted, but when not enough duct wall is available, one line of sutures answers the purpose. Whatever drainage is necessary, one is lead to infer, will take place *per viam naturam*.

Davis²³⁰ believes that the most frequent cause for the lack of complete relief after gall-bladder and duct operations are: (1) Impediments—strictures, torsions and lessened elasticity of the common and hepatic duct wall to permit of easy passage of bile into the duodenum; (2) the tendency to reinfection; (3) adhesions; trouble in the stump of the cystic duct. Davis believes that if some effective method of preventing postoperative adhesions could be found, most of the gall-bladders now removed could be saved. (This seems questionable. Reviewer).

Choledocho-Enterostomy. In discussing the methods of common bile duct reconstruction, Barber²³¹ concludes that:

1. A severed bile duct too small for suture but sufficiently long enough may be reunited with the small intestine or the stomach by anchoring it obliquely within the wall of the viscus.

2. Of 20 animals, 18 with temporarily obstructed ducts developed patent functioning anastomoses in 72 per cent.

3. A certain degree of dilatation due to the inevitable interruption of the normal nervous connections during reconstruction of the bile ducts, is not incompatible with life. Harmful dilatation is associated with retraction of the transposed end, obstructive mural scarring and deficient epithelialization.

4. Barber's technic reduces the adhesion-forming traumata to a minimum and includes (a) proper mobilization of the anastomotic intestinal loop; (b) oblique course of the intramural part of the duct; (c) possibly dilatation of the intramural end and (d) anchorage with due allowance for retraction.

THE PANCREAS.

Contusion of the Pancreas. In Van Dam's²³² case the patient was a young man who was gored by the horn of a bull. The condition did not seem serious at first. Symptoms developed very soon, however, and on the third day a laparotomy was done. It was possible to demonstrate

²²⁹ Journal of the American Medical Association, 1919, lxxiii, 1750.

²³⁰ Ibid., lxxii, 305.

²³¹ Annals of Surgery, 1919, lxx, 530.

²³² Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, 1919, i, 1091, Abstract, Journal of the American Medical Association.

an escape of pancreatic juice into the bursa omentalis, and, through the Foramen of Winslow, into the general peritoneal cavity; the pancreatic duct was lacerated. Notwithstanding thorough drainage, symptoms of ileus supervened and the man died after an enterostomy and one month after the accident. Van Dam has found 25 cases on record of isolated injury of the pancreas, and 62 cases of isolated contusion of the pancreas. Traumas of various kinds seem to be important factors in the development of cystic disease of the pancreas.

Cysts and Pseudocysts of the Pancreas. Pancreatic and pseudopancreatic cysts, while not rare, are of sufficient importance to be recorded. Kerr²³³ points out that the x-ray is an important aid in diagnosis in showing the position of the cyst in relation to the stomach and other organs. The treatment is surgical, usually incision and drainage. Sometimes, in favorable cases, the cyst may be entirely enucleated. Diabetes is an occasional complication of pancreatic cysts, and, when present, renders the operation more dangerous. One should not, however, hesitate to give even these the benefit of operation when less than 4 per cent. of sugar is present (C. H. Mayo²³⁴) and after giving a diabetic diet and a course of alkaline treatment to minimize the acidosis.

Sclerosis of the Pancreas. Bonorino and Carulla²³⁵ report a case in which paroxysms of agonizing pain were, at first, related to the taking of food; later the pain became continuous and persistent and became associated with a progressive weakness. Achylia gastrica was present. There was no glycosuria and functional tests in regard to pancreatic activity were negative. No tender points could be demonstrated. No relief followed any of the ordinary measures including a course of anti-specific treatment. Abdominal exploration was negative. The man died five days after operation: The postmortem examination showed a sclerosis of the head of the pancreas the remainder of the organ being normal. The pains, perhaps, were caused by compression of some part of the solar plexus, according to Bonorino and Carulla.²³⁵ It is possible too that the pains were due to some bloodvessel changes, inasmuch as the man had had one of his legs amputated for obliterating endarteritis a number of years previously.

Acute Pancreatitis. There were two communications during the year which took up the question of the etiology of pancreatitis. Deaver²³⁶ believes in the theory of Maugeret,²³⁷ supported in Germany by Ansperger,²³⁸ that in many cases the cause of the pancreatitis is to be sought in a spread of infection from the gall-bladder wall through the lymphatics to the cystic lymph node, thence by periductal lymphangitis through the nodes along the common duct to those at the head and margin of the pancreas and thence to the regional lymphatic distribution in the head of this organ. With this hypothesis in mind,

²³³ Surgery, Gynecology and Obstetrics, 1918, xxvii, 43.

²³⁴ Quoted by Kerr.

²³⁵ Prensa Medica Argentina, Buenos Ayres, 1919, vi, 9; Abstract, Journal of the American Medical Association.

²³⁶ Surgery, Gynecology and Obstetrics, 1919, xxviii, 433.

²³⁷ Thèse de docteur, Paris, 1898.

²³⁸ München. med. Wehnschr., 1911, p. 729.

Deaver believes in the early surgical treatment of upper abdominal conditions as a prophylactic measure and before a possible pancreatitis has had time to develop and get in its destructive work.

A hitherto commonly accepted mechanism for the production of acute hemorrhagic lesions in the pancreas has been concerned with the passage of bile into the pancreatic ducts; and since the report of Opie in 1901, the belief has been very prevalent that the cause of the retrojection of the bile has been a plugging of the papilla of Vater by a small gall-stone. In a number of cases, however, it could be demonstrated (Archibald and Mullaly²³⁹) that no stone had blocked the combined exit of the bile and pancreatic ducts.

The recent communication of Archibald²⁴⁰ deals with the relationship of Oddi's sphincter (common duct sphincter) to the production of acute and chronic pancreatic lesions. His experimental work has added the observation that bile, when under pressure, can be caused to flow into the pancreatic ducts by a reflex spasm of the sphincter: the spasm can result from a variety of sources of irritation. In the experimental animals there was no question of any mechanical obstruction to the outflow of bile into the duodenum; the obstruction was purely a physiologic one. Most of the main types of lesion found in clinical practice were reproduced in this way. The experiments also seem to show very clearly that the necrosis of the pancreas is the direct result of the action of the substances entering the duct of Wirsung. Archibald believes that the extent of the necrosis is determined at the outset of the disease by the virulence and extent of the permeation of the noxious agent. Succeeding invasions of bile may increase the extent of the necrosis. Liver necrosis of the type now known as focal necrosis, occurring during pancreatitis, were found with great regularity both in the fatal and mild cases and were present within twenty minutes of the operation. The severe cases with early death were all in the series in which infected bile was used. Sterilized mucin-free bile, or solutions of bile salts, also caused necrosis of the gland but in a degree compatible with recovery; while the infected bile almost regularly caused death usually with, occasionally without, severe lesions in the pancreas. The surgical treatment must lie in prevention of any further retrojection of bile into the pancreas. The damage already done to the organ will often be cured by the processes of nature—absorption, replacement, or even sequestration. On the other hand, if gangrene, abscess or even total slough has occurred, it may require a direct attack on the pancreas itself. But to prevent recurrence, or extension, the cardinal point would seem to lie in the prevention of any heightened pressure in the biliary system and, secondly, in the restoration of an altered bile to its normal chemical condition, or of an infected to a sterile bile. This can only be done by a drain in the gall-bladder or common bile duct. The essential thing seems to be prolonged drainage.

Archibald does not believe in the transmission of infection by the lymphatics as a cause for the pancreatic lesions. However, when all

²³⁹ Canadian Medical American Journal, 1913, 42, n. s. 3, 87.

²⁴⁰ Surgery, Gynecology and Obstetrics, 1919, xxviii, 529.

things are considered, it is very probable that both of these methods functionate in the production of pancreatic lesions. It seems quite reasonable that the more chronic and fibrotic lesions of the pancreas result from the continued exhibition of a focus of infection in the biliary apparatus; while the more acute cases result from the retrojection of bile into the pancreatic duct. In the latter it is probable that cases occur both in the presence of an actual blocking by stone and because of the reflex spasm from a source of irritation. Perhaps, in some, both of these later functionate; the blocking by stone becomes the reflex source of the irritative spasm.

Urrutia²⁴¹ reported an extraordinary accident in which a pancreatitis followed a resection of the stomach. The stump of the duodenum had been sutured to the head of the pancreas for want of any other method of peritonealization.

Cancer of the Pancreas. Fitcher²⁴² has collected 58 cases of cancer of the pancreas from among 41,000 patients admitted to the Johns Hopkins Hospital. The diagnosis was confirmed by operation or necropsy in 38 of the cases. There were 21 in males and 9 in females; in the others there is no notation of the sex. Most of the patients were in the fifth decade of life. Pain was a prominent symptom in all but 6 of the cases and it was located in the upper abdomen. Jaundice was the most common symptom; this was progressive, persistent and intense. One patient had the appearance of an argyria. A palpable tumor was present in 12 cases in the apex of the epigastrium; this did not descend on deep inspiration. A distended gall-bladder seemed to be an important diagnostic physical finding and was different from the blocking of the duct by stone which did not cause distention of the gall-bladder. In nearly all of the cases there was an enlargement of the liver from the jaundice but the latter lacked the other characteristics of a catarrhal jaundice. Sometimes there was a lack of pancreatic function and alcoholic stools were noted with an excess of fat: such a condition was present in 22 of 30 cases; in 2 others there was actual fatty diarrhea. Glycosuria was present in 10 per cent. of the patients. The tumor was usually in the head of the organ; in one it was in the body. Eight of the tumors were primary in the pancreas; 2 were secondary to tumors of the stomach and gall-bladder respectively; these were adenocarcinomata; one other was an hemangioendothelioma.

A perithelioma resembling a pancreatic cyst in its clinical manifestations was reported by Smith²⁴³ last year.

THE SPLEEN.

Comparative Method of Measuring Spleens. Chauffard's²⁴⁴ method of measuring the spleen is as follows: A line is drawn from the middle of

²⁴¹ Siglio Medico, Madrid, 1918, lrv, 22; Abstract, Journal of the American Medical Association.

²⁴² Transactions of Association of American Physicians, June, 1919.

²⁴³ British Medical Journal, 1919, ii, 270.

²⁴⁴ Bull. de la Soc. Méd. des Hôp., Paris, 1919, xliii, 554.

the axilla to the trochanter region with the arm held above the head. This line serves as the base line from which the other measurements are reckoned. The outline of the spleen is determined by percussion and palpation and marked on the skin. A line is then drawn from the base line, axially, to the farther limit forward of the spleen. This axial line is bisected in the center by a line perpendicular to it. Thus, two lines are provided which can be measured and compared from case to case, giving the approximate size of the spleen.

Role of the Spleen in Infections. The results of Morris and Bullock's²⁴⁶ experiments show in a very definite way that, while animals may get along fairly well without the spleen in the absence of an infection, the reverse is the case when the organism is put to the test of resisting the strain of any acute bacterial invasion. Under the circumstances one must infer that, in rats, the spleen normally aids tremendously in resisting infectious processes; and that its removal temporarily robs the body of its resisting power until such time, at least, as compensatory processes have a chance to reestablish themselves.

The surgical bearing is obvious. If, as we may reasonably infer, the physiological processes of mammals are similar, it is not improbable, that the human body, deprived of its spleen, shows a similar increased susceptibility to infections. Bearing this in mind, some of the fatalities following splenectomy, especially where death was attributed to infection may find a ready explanation and may tend to increase our caution in the removal of the organ.

Transplantation of the Spleen. Kawamura²⁴⁶ communicates the results of his attempts to transplant the spleen. There are usually 2 trunks of both the artery and the vein to the spleen from the gastrosplenic vessels. One pair enters the spleen at its lesser (left) end, and another at about the middle. In these experiments the spleen was divided into two parts, corresponding to the stream district of the two branches, after mattress sutures had been applied transversely on it. The half, which was nourished by the larger branch was utilized for the transplantation. The attached omentum was cut off after ligation. The splenic artery, veins, and nerves were dissected and divided. The appropriate part of the organ was then removed and wrapped in a wet sponge. After a few minutes the spleen was replaced and its vessels reunited as before by end-to-end anastomosis. In one case an attempt was made to transplant the spleen into the neck; in another, into the renal vessels after nephrectomy. Most of the experiments were performed autoplastically, but in one the spleen from one, was transplanted into another animal. The circulation in the spleen was reestablished from one to two hours after its interruption. The dissected omentum was reunited and in a few cases the nerves were also sutured. Several days after operation the condition of the organ was ascertained by laparotomy. When the transplantation was successful the other intact half of the spleen was removed for microscopic examination, and the animal was observed further. The results, immediately after operation, were satisfactory

²⁴⁶ *Annals of Surgery*, 1919, lxx, 513.

²⁴⁶ *Journal Experimental Medicine*, 1919, xxx, 45 and 65.

in all cases. But, later, most of the spleen became necrotic or was entirely absorbed. The cause for this was obstruction in the transplanted vessels due to thrombosis. Only one autotransplantation was successful, the gland being normal at the end of thirty-eight days.

Torsion of the Spleen. From a personal case and from those reported in the literature, Kopp²⁴⁷ comes to the conclusion that splenectomy should be the routine treatment after torsion of a movable spleen; he advocates this as a precautionary measure when the movable spleen is large and likely to cause trouble later. In following 8 cases for a year's time after operation, Kopp²⁴⁸ could make no determination that a chronically congested and enlarged organ would revert to a normal size. The mortality of splenectomy, when done for torsion, is 11.5 per cent. of 35 cases. The sudden onset with intense pain, and peritoneal irritative symptoms, with a palpable tumor having a characteristically splenic shape and developing in a few hours aid in the differential diagnosis. There is no abdominal rigidity at first. Kopp warns that the organ may have been already compromised beyond recovery. Splenopexy may be followed by a recurrence of the torsion.

Non-Parasitic Cysts of the Spleen. A case, cited by Lambert,²⁴⁸ substantiates the fact that there is no group of symptoms which can be recognized as characteristic of splenic cysts. The cases present a varied picture referable, mostly, to neighboring organs and directly due to the great enlargement of the spleen. Lambert discusses the pathogenesis of cysts lined by connective-tissue cells occurring in various parts of the body as in bones, thyroid, omentum, mesentery and elsewhere. It is suggested that the cysts had developed as the result of an infarct or hematoma. Lambert quotes Fowler's classification of non-parasitic cysts:

1. Traumatic cysts (hematoma); these are large and unilocular.
2. Infoliation cysts (traumatic, or inflammatory inclusions of peritoneum); these are small and multiple, superficial and deep.
3. Dilatation cysts (ectosis of sinuses).
4. Disintegration cysts (arising from arterial degeneration and occlusion, or other arterial occlusion as from emboli, and resulting in infarction and necrosis of the parenchyma).
5. Neoplastic cysts (hemangioma and lymphangioma).
6. Degeneration cysts (arising from secondary changes in group 5.)

Tuberculosis of the Spleen. The differential diagnosis of tuberculosis of the spleen is based on the chronic course, the personal and family history, the enlargement of the spleen with little, if any, tenderness in it and the presence of other tuberculous lesion, when present. (Reviewer.) The differential diagnosis must be made from other forms of splenomegaly, but the chief difficulty lies in excluding pseudoleukemia and polycythemia; the differentiation may be difficult even at a laparotomy. In advanced necropsy cases the spleen has weighed as much as 4 pounds (3780 gms.).

²⁴⁷ *Nederlandsch Tijdschrift v. Geneeskunde*, Amsterdam, 1919, i, 379; Abstract, *Journal of the American Medical Association*.

²⁴⁸ *Annals of Surgery*, 1919, lxi, 15.

Peterson²⁴⁹ believes it to be justifiable to operate upon these patients with the object of removing the spleen, even if there be tuberculous lesions elsewhere in the body. The mortality in Peterson's cases has been 25 per cent.; and, when last heard from, 60 per cent. of the remainder of his patients were well.

Syphilis of the Spleen. Eason²⁵⁰ describes a case in which the clinical picture simulated that of Banti's anemia with the added laboratory finding of a positive Wassermann test. In massive syphilitic splenomegalies, Symmers, Gettler and Johnson²⁵¹ have observed certain characteristic vascular changes. In the splenic substance there were visible, variable numbers of pin-head size, round or oval, or angulated bodies with a brownish, or yellowish brown, granular looking center and with peripheral zones colored reddish. These bodies, which correspond, histologically, to sclerosis and mineralization of the smaller arteries, are characteristic and readily identifiable, and are distinct from anything familiarly encountered in the naked eye examination of the spleen. The substance of the spleen presents a reddish flesh-like appearance with a leathery consistence; on section, numerous small vessels are also discernible, whose walls are pale and thickened, and which correspond, microscopically, to venules in, or around, which hyaline deposits have occurred but which are immune from infiltration with mineral salts. Hemorrhages may be seen by the naked eye and, histologically, are found in various stages of organization. In addition, the splenic substance is extensively replaced by a productive over-growth of connective-tissue of inflammatory origin.

Eason²⁵⁰ has found records of 7 other cases in the literature, which were similar to his own. Employing these as criteria, he compares the medical and surgical treatment and comes to the conclusion that energetic medical treatment is indicated at first; if sufficient improvement is not forthcoming within a reasonable time, splenectomy should be practised.

THE SUPRARENALS.

Radiosusceptibility of the Suprarenals. Zimmern²⁵² has succeeded in making x-ray exposures of the suprarenal bodies and induced histological changes in animals and functional changes in man without any appreciable by-effects in the skin and kidneys. In the clinical cases of hyperfunction of the suprarenals with high blood-pressure, the latter dropped down in every case in from two to ten days and the drop ranged from 2 to 8 cm. The blood-pressure remained at this lower point for a shorter, or longer, time and up to several months time in some of the patients.

Acute Hemorrhagic Lesions of the Suprarenal Bodies. One of the men at Camp Dodge fell ill with an acute disease, characterized by fulminant abdominal symptoms, which rapidly went on to a fatal termination.

²⁴⁹ Hospitalstidende, Copenhagen, 1918, 61; Abstract, Journal of the American Medical Association.

²⁵⁰ Edinburgh Medical Journal, 1918, xxi, 258.

²⁵¹ Surgery, Gynecology and Obstetrics, 1919, xxviii, 58.

²⁵² Bull. de l'Acad. de Méd., Paris, 1919, lxxxi, 791.

At the postmortem examination, hemorrhage was found to have occurred into the suprarenals. The fact that in this instance *Streptococcus hemolyticus* was isolated from the blood both before and after death, and that the case followed shortly after the empyema epidemic at the camp, led to the supposition that the organism was the exciting cause. It seems quite reasonable to assume that by the lodgment of a bacterial embolus in a vessel lumen, or in the wall itself, a dissolution of the vessel occurred and permitted the hemorrhage and the resultant death. The clinical picture included the manifestations of a severe septicemia. The case is reported by Lusk and Brumbaugh.²⁵³

In children, Friderichsen²⁵⁴ reports that most of his cases of suprarenal hemorrhage were in nurslings; only 3 cases were in children between two and three years, and only 1 in a child of fourteen years. The little patients were all apparently well nourished and thriving, when they awoke one morning screaming with pain; sometimes they vomited, sometimes there was diarrhea, sometimes with convulsions and always with intense cyanosis and pallor. There was no sign of any lung involvement. There was a high temperature, small, irregular pulse, and sometimes unconsciousness or great distress. The cyanosis extends around the trunk and on the extremities and nates; in a few hours petechiæ develop; death follows in from six to twenty-four hours after the first symptoms. No cause is usually demonstrable until the post-mortem examination discloses the hemorrhage in the suprarenal bodies.

It is curious to note that in 12 of the children cultivation of the blood during life yielded bacteria of various kinds—staphylococci, streptococci or pneumococci—seven times; this corresponds to the finding in the Camp Dodge case. In none of the cases was the hemorrhage sufficient to rupture the capsule.

Death seems to have resulted from the acute insufficiency of the suprarenal function, and this suggests that the exhibition of adrenalin in the proper time might, perhaps, have warded off the serious consequences. The cutting off of the natural adrenalin supply relaxes the tonus of the bloodvessels; perhaps this explains the cyanosis and the purpuric eruption. The absence of hemorrhage in other internal organs shows that a general hemorrhagic tendency is not in play here. All of Friederichsen's children died. The occasional discovery, however, of signs of old hemorrhage in one of the bodies at the postmortem examination of children dying from other causes, shows that this suprarenal apoplexy is not always inevitably fatal.

Friederichsen suggests it as possible that different hemorrhagic conditions of the blood and mucous membranes are the results of temporary insufficiency of the chromaffin system over the precariousness of which emergency one may tide a patient.

Eli Moschcowitz²⁵⁵ seeks to classify under the comprehensive term of "focal necroses" hemorrhagic as well as other degenerative lesions of

²⁵³ Journal of the American Medical Association, 1919, lxxii, 1062.

²⁵⁴ Ugeskrift for Læger, Copenhagen, 1917, lxxix, 1817. Abstract, Journal of the American Medical Association.

²⁵⁵ American Journal of Medical Sciences, 1919, clvi, 313.

the adrenal. Much work has been done, especially by the French school in obtaining lesions of the suprarenal bodies by the injection of pathogenic bacteria. The first work was done by Roux and Yersin in 1889; the most comprehensive studies are those of Oppenheim and Loeper who obtained lesions in diphtheria, tetanus, anthrax, and pneumococcus infections. The latter describe hemorrhages, infiltration with leukocytes, parenchymatous degenerations and necrotic foci; these are especially characteristic of diphtheria infections. So far as the available data permits him to judge, Moschcowitz believes that adrenal lesions may result from a general toxic action—degenerations, hemorrhages, necroses—or from the action of bacteria themselves—bacterial emboli, abscesses.

GYNECOLOGY.

By JOHN G. CLARK, M.D.

CANCER OF THE UTERUS.

The Cancer Problem. It is now well over a year since the cessation of hostilities in Europe and although the world at large is in a rather upset condition, the medical profession is gradually returning to a pre-war status. Most of the physicians who left practices and laboratories when the United States entered the war, have again resumed their civilian vocations. The medical journals, which for many months contained practically nothing but military medicine and surgery, have again assumed a peace time appearance, while the various foreign journals, which for several years were not being received in this country, are now appearing regularly. With this transition it is to be hoped that, in the near future, we shall be able to record some epoch-making research in the cancer problem, although this year we have little to present in the way of new discoveries.

It is gratifying to note, however, that the educational campaign is ever broadening and the wonderful work that was presented by Hoffman¹ as a contribution to science from a large insurance company has been emulated by the Metropolitan Life Insurance Company who have published a book entitled "Mortality Statistics of Insured Wage-Earners and Their Families" which has been edited by their statistician, Mr. Louis I. Dublin. From the title it may be noted that this volume embraces mortality statistics from all causes, but nevertheless a section of the book which is devoted exclusively to cancer contains many interesting statistical facts and we shall quote freely from this part of the book.

During the six-year period of this investigation, 37,666 cancer deaths were recorded at a rate of 70 per 100,000 persons exposed. Cancer was the sixth cause in order of numerical importance in this study. These deaths constituted 5.9 per cent. of all the deaths in the experience. Cancer and other malignant tumors of the stomach and liver constituted the largest single group of malignant growths, with 37.6 per cent. of all cancers, at a rate of 26.3 per 100,000 persons exposed. Cancer of the female genital organs was next in importance, with 7882 deaths, constituting 20.9 per cent. of all cancer deaths, with a rate of 14.7 per 100,000 persons of both sexes. Cancers affecting the peritoneum, intestines and rectum followed with 4482 deaths, in all 11.9 per cent. of all cancers at a rate of 8.3 per 100,000. These death-rates, however, vary considerably with age and sex. For all ages one and over combined, white persons show higher cancer death-rates than colored persons, although the white

¹ PROGRESSIVE MEDICINE, June, 1917, p. 158.

female rate is only slightly higher than that for colored females. Various differences between the cancer death-rates of the color and sex classes occur for this disease as it affects various organs or parts. White males, for instance, show uniformly higher cancer death-rates for each of the organs or parts than are in evidence for colored males. White females show significantly lower cancer death-rates for this disease only as it affects the female genital organs and the breast. Cancer of the uterus and of the other genital organs shows a rate of 25.3 per 100,000 white females exposed and a rate of 37.9 for colored females. Cancer of the breast, in this present mortality experience, was recorded at a rate of 11.7 per 100,000 white females, and at a rate of 14.7 per 100,000 colored females. For the other chief organs or parts, cancer mortality of white females is greater than among colored females.

White males show emphatically higher cancer death-rates at every age period than were recorded for colored males. Comparisons between the cancer death-rates of white and colored females are practicable beginning with the age period twenty-five to thirty-four years. Between twenty-five and forty-four years, the cancer death rate of white females was decidedly lower than the rate for colored females. Between forty-five and fifty-four years, the rates were practically the same. Beginning with the age-period fifty-five to sixty-four years and continuing to the highest age period in the table, we observe that the cancer death-rates of white females were much higher than the rates for colored females. These differences in the total cancer death-rates of white and colored females are to be accounted for, as will be shown later, by the higher mortality from cancer of the generative organs among colored females. We have seen that among white lives the cancer death-rate of females was practically one and two-thirds that of males. Cancer mortality of white males exceeds that of white females only for cancer of the buccal cavity, where the rates are 4.6 and 0.9 per 100,000 persons exposed, respectively; for cancer of the skin, where the rates are 2.2 and 1.6 respectively, and for the group of "cancers of other organs or of organs not specified." For cancer of the stomach and liver and of the peritoneum, intestine and rectum, the death-rates of white females were decidedly in excess of those for white males. In addition, white females showed a high death-rate for cancer of the female genital organs (25.3 per 100,000) and for cancer of the breast (11.7 per 100,000). Practically the same general remarks apply to the comparative cancer death-rate of colored males and colored females when compared with respect to the several organs affected by malignant growths. There are no important differences in the cancer mortality of the two sexes among white lives under twenty-five years of age. Beginning with the age-period of twenty-five to thirty-four years, however, the cancer death-rate of white females exceeds those of white males substantially, up to and including the age-period of fifty-five to sixty-four years. Thus at the age-period of thirty-five to forty-four years the rate for white males was only 38.6 per cent. of that for white females. After age sixty-five, the disproportion between the rates for the two sexes among white lives is not so great. The excess of the cancer death-rate of colored females over the rate for colored males

is much greater than was observed, age-period by age-period, for white lives. Thus between twenty-five and forty-five, the rate for colored males was only about one-fourth as great as for colored females.

As a result of an extended consideration of the data developed in this inquiry into the *possible relation of cancer and economic conditions*, it was concluded that the current medical opinion, that there is strong association between low economic status and a low cancer death-rate, is in all probability unfounded and the cancer mortality rate at the ages where the cancer rate is significant, decreases as we go up in the economic scale. This is shown to be true for each sex where sufficient data are available. Medical literature of the past few years contains much controversy on the question as to whether mortality from cancer is actually increasing or not. One school of research holds "that the mortality from cancer is increasing at a more or less alarming rate throughout the entire civilized world and that this increase implies most serious consequences, present and future, to the populations concerned" (Hoffman).² Another group of statisticians hold that "the reported mortality from cancer is increasing in almost every part of the world, but the real mortality, if increasing at all, is certainly not increasing with equal rapidity. The cumulative evidence that improvements in diagnosis and changes in age composition explain away more than half and perhaps all of the apparent increase in cancer mortality rebuts the presumption raised by the figures and makes it probable, though far from certain, that cancer mortality is not increasing" (Willcox).³

It is not the purpose of this section to take sides in a controversy. It is desired to offer the mortality records of the present investigation only as a contribution to the available supply of trustworthy data on the trend of cancer mortality. Cancer death-rates in this present experience, covering six calendar years, and relating in all to fifty million years of life exposed to risk, show no decisive upward or downward tendency for all age classes combined. This is true for each color and sex group, but more decisively for the group of insured white females for whom the highest rates are recorded. Our data, therefore, need not serve to confirm either one of the two opposing opinions and, in fact, point out the necessity for reserve and caution in predicating any decisive opinion with regard to the real trend of cancer mortality during recent years. A longer period of time will be required to collect authentic figures upon which a definite judgment can be based. Considerable analysis of cancer data according to age, sex, color and organ or part affected will be necessary before any final conclusion can be drawn as to the amount of increase, if any, in recent years.

Directing our attention to the female generative organs, we note that cancer of these organs accounted for 28.6 per cent. of all cancer deaths among white females. The very largest proportion of these cancers affected the uterus, with the ovaries and Fallopian tubes next in numerical importance. In all, 7882 deaths from cancer of the female genital organs were recorded in the six-year period of this study. The rate has

² Hoffman, loc. cit.

³ PROGRESSIVE MEDICINE, June, 1918, p. 162.

significance only when the deaths are related to the number of females exposed. The 6499 cancers registered among white females corresponded to a rate of 25.3 per 100,000 of such females exposed and the 1383 deaths among colored females to a rate of 37.9 per 100,000 exposed. Under the age of twenty-five years, there was no significant mortality from this cause. Beginning with the age-period of twenty-five to thirty-four years, however, there was a quite considerable rate of mortality, 7.9 per 100,000 for white females and 17.7 for colored females. This excess in the mortality rate from cancer of the female genital organs among colored females is decidedly marked at all of the age-periods in this series. The maximum rates of mortality from this cause appear at the older ages.

Educational Campaign of the Profession. In February, 1917, by vote of the National Council of the American Society for the Control of Cancer, a committee was appointed to prepare the manuscript of a Handbook on Cancer for circulation among the members of the medical profession of the United States. This was done as a part of a campaign the Society inaugurated for the collection and dissemination of facts in regard to cancer, to the end that its mortality might be reduced by a wider knowledge of the disease. The first manuscript was submitted to the Council of the Society at a meeting in April, 1917. The manuscript was then sent to a number of different members of the Council for the critical review of special sections of the pamphlet. The criticisms and suggestions thus obtained were utilized in a subsequent revision of the manuscript, which was submitted to the Council at a meeting held on October 26, 1918, and with certain changes, accepted and ordered published with the endorsement of the Council and in the name of the Society. The Handbook is designed to provide in a brief and readily accessible form the important facts about cancer in general, and its manifestations in the different situations where it most commonly occurs. The critical and controversial review of public statistics as to the end-results of operative treatment could not be included without enlarging greatly the size and scope of the publication. It was decided, therefore, to present only in general terms the expectations of success attending the radical operative treatment of cancer in each of its different situations. It is believed that in these statements, as in other respects, a conservative view has been taken of the situation and that the statements made can be thoroughly substantiated by the published experience of the foremost surgeons of the country. The Handbook has been published by the American Medical Association and is replete with information of great value to the general practitioner, but in quoting from it, lack of space compels us to confine ourselves to that phase of cancer which concerns us as gynecologists.

As a result of this campaign which has been conducted by the American Society for the Control of Cancer for the education and enlightenment of the lay public on the subject of cancer, a greater and more accurate knowledge of this disease is already evident, and many fallacious ideas have been corrected. This has been the primary and most necessary step in the campaign to reduce the very great, and often unnecessary, mortality of this disease, for until the patient of his own accord seeks

medical advice, no step can, of course, be taken toward making a diagnosis or applying the proper treatment. Much yet remains to be done in the way of education of the public, not only in the more remote rural districts but in the towns and cities as well, and it must be done wisely and temperately, and without producing so great a fear of the disease as to alarm people unnecessarily. It is the knowledge that the disease can be cured by radical treatment in its earliest stages that must be disseminated. Many laymen, and some physicians find it hard to believe this fact. Cancer is not a disease that runs its course, like pneumonia or typhoid: it is an actual entity—as much a part of the individual as his finger or his nose, and it is either still a part of him and growing to a fatal termination or it must be removed entirely in order that it may be cured. The layman knows of the many cases that are not cured, whether an attempt at cure by operation has been made or not, but he rarely knows of the cured cases, for the reason that the individuals who have been relieved of the disease by operation go about their business as well as ever, and disguise, so far as possible, the loss of the organ or the scar of the operation, by which life has been saved. It is difficult to controvert this personal experience of the individual by assertion of the possibilities or probabilities of cure by operation, but it must be done if the public is to understand the actual facts of the cancer problem. Every physician should feel it his duty to make these facts clear to the laymen within his reach. The physician of the present day must do far more than care for the cases of disease that call for his help. He is the health officer of his own clientele, and they look to him for knowledge to protect them from disease. The instruction which has been given to the public is already bearing fruit, and from many communities comes the report that patients now present themselves to their physicians much earlier than in the past with symptoms that they consider suggestive of cancer. Under these circumstances it behooves us to consider, as members of the medical profession, the obligations which rest upon us as the nearest and the first sought source of scientific knowledge, to give to our patients that wise counsel which they have a right to expect.

During the past ten years commissions and laboratories for cancer investigations have been established in many places in the United States as well as abroad. In all of these centers, research work has been carried out on the tumors of animals as well as on human cancer. All of the resources of chemistry, physics, physiology and biology, and the study of immunity reactions have been brought to bear upon the problem, and the work is still being carried on: but, as yet, the ultimate cause of cancer is not known. Many important facts, however, have been discovered, and by every fact contributed the growing structure of our knowledge of the disease is built up until, for instance, we now know many things that cancer is *not*, and useless expenditures in investigation along those lines have ceased. We know that cancer is not due, in the sense that infectious diseases are due, to a parasite. We know that cancer is not communicated from one person to another, and that there is no danger of the nurse contracting the disease in caring for the cancer patient. We know that the influence of heredity in the incidence of the

common forms of cancer in human beings is so remote that the factor of inheritance may, as a rule, be disregarded. We know that one form of cancer after another has been brought in relation to some form of chronic irritation, as a direct or indirect predisposing influence, and that cancer of the cervix, the lip, the tongue, the rectum, the stomach, and many of the forms of malignant disease of the external skin—Marjolin's ulcer, the Kangri cancer of Kashmir, the paraffin worker's cancer, and the roentgen ray worker's cancer—are all closely associated in their inception with one form or another of chronic and repeated irritation. It has also been shown in the laboratory that rough compression and manipulation of a tumor are fully capable of setting its cells free to form metastases, and from this we learn to use the utmost gentleness in the palpation of a tumor for diagnosis, as well as to avoid compression, dragging, and all unnecessary trauma to cancer tissue during the operation for its removal. All of these facts we owe to the laboratory investigation of cancer, and we may reasonably hope that the next decade will contribute as much, or more, information concerning this disease. Erosions and lacerations of the cervix of the uterus, the almost inevitable result of childbirth, are the most common factors predisposing to cancer of the cervix. While it is customary for the physician to repair immediately the more serious lacerations of the cervix, less extensive lesions can be detected only at a later period after involution has occurred. The routine examination of all women for cervical lesions three months after labor has been advocated, that these lesions may be immediately repaired, and the predisposition to cancer avoided. It is advisable that all women who have borne children, as they approach the menopause, should have a vaginal examination and an inspection of the cervix at reasonable intervals until the menopause is well established and the normal atrophic changes have taken place. Deep lacerations should be repaired, and superficial lesions, if resistant to local treatment, are sufficient indication for amputation of the cervix. The hyperplastic endometritis which accompanies fibromyoma of the uterus is also believed to be one of the most important predisposing causes of cancer of the fundus.

Cost of Cancer in Norway. The various disasters to which death and disease give rise have an economic side, which occasionally makes itself strongly apparent. Gade⁴ has therefore tried to calculate the economic losses to Norway brought about by death from the cancerous diseases (carcinoma and sarcoma) in that country. These calculations are based on the one side upon the mortality statistics and on the other upon the valuation of Norwegian lives as computed by the Director of the Norwegian Statistical State Bureau. As a result of this study, it appears that there is an average yearly loss through death from cancer of about \$1,800,000 in this country where the population is scarcely 2,500,000 inhabitants. This amount represents only the direct loss of life-capital and must be considerably increased if other sources of economic loss through the diseases in question are to be considered.

⁴ Journal of Cancer Research, 1919, iv, 203.

Delay in Treatment of Cancer. A careful record was kept by Farr⁴ of 103 cases of malignant diseases entering the Cornell Surgical Division of the New York Hospital in regard to the duration of symptoms and the various reasons for delay in seeking treatment. Of all the cases in this series, the average period from the onset of symptoms to the first consultation with a physician was 3.19 months and the average period from this time until the entrance into the hospital was 8.7 months, giving a total of 11.89 months, practically a year, in the average case from the onset of symptoms to the entrance into the hospital. The advice of the physician first consulted was then considered in relation to each case, being classed as *right* or *good* when he urged the hospital or operation, *wrong* when he did otherwise. An analysis of this study showed these results:

	Total number.	Right.	Wrong.
Curable cases	18	11	7
Probably curable cases	35	17	18
Operable cases	71	37	34
Inoperable cases	29	12	17
Incurable cases	48	16	32

Of course these data are too meagre for definite conclusions, but it is obvious that in the average case a considerable percentage of time is lost between the onset of symptoms and the first visit to a physician, that the physician's advice is wrong in considerably more than half the cases and finally a much longer period after the first consultation is wasted before the patient enters the hospital. In extenuation it may be said that the average physician sees not more than one case of cancer in a year, judging from the latest statistics available and it is too much to expect him to be able to make refined diagnoses under the circumstances but he should be taught, and so should the laity, that an early slight operation offers far better prospects than a late severe one.

Connective-tissue Theory of Cancer. A theory of origin of cancer that has been advanced by Soresi⁵ explains malignant tumors by the following sequence. First, some loss of substance, then the healing over with cicatricial tissue, then the infiltration of this cicatricial tissue with some of the original cells from the tissues on which the cicatricial tissue has developed. These infiltrating cells get shut off from their sister cells, and get imprisoned in the connective tissue without any connection with the mother tissue below. These imprisoned cells retain their vitality but lose their physiologic balance. Then as the imprisoning connective tissue cells grow old and weaker, the original cells are released. Then they start to grow independently, free from the restraint of their connection with the mother tissue, and this is the nucleus of the cancer. Soresi does not believe that the cancer cell is specially malignant *per se*. Its unbridled multiplication is due only to the fact that the metabolic phenomena of these cells are not in harmony with the physiologic phenomena of the organism. Having been taken out of the location in which they were accustomed to live, they have acquired other habits

⁴ American Journal of the Medical Sciences, 1919, clvii, 34.

⁵ Policlinico, 1919, xxvi, 12, by Journal of the American Medical Association.

and have become like cretins and idiots, of filthy and destructive habits, defiling and destroying their own food and themselves. It would take years to induce experimentally malignant growths by this mechanism, but Soresi's attempts in this line had given hints of promising results when he dropped this research to serve in the war but he hopes that others may be inclined to carry it on.

Dietetic Theory. The more one sees patients with cancer, early or late, in private practice and studies them most carefully in all respects, the more convincing is the evidence of the correctness of the constitutional or dietetic theory of cancer, according to Bulkley⁷ who has presented his views on many occasions. He states that when one sees day by day the changes which can be produced in them, and the steady disappearance of cancer masses, with the continued improvement in general health, weight and blood conditions, under proper dietary and medical treatments as have many physicians and surgeons who have followed cases over a period of years, the more the conviction forces itself upon one that the local lesion which we call cancer, is but a *local product* of faulty metabolism which has long existed. According to this author, the mortality from tuberculosis has steadily and greatly diminished under careful medical guidance, while that from cancer has increased in almost the same ratio, without proper medical care. Cancer is almost absent among aborigines, living simple lives, largely vegetarian, but has increased steadily among them in proportion to their adoption of the customs and diet of so-called modern civilization. Self-indulgence in eating and drinking, with indolence, has been shown by many to result in increased cancer mortality. The increased consumption of meat, coffee and alcohol has been shown by statistics from many countries to be coincident with an increase in cancer mortality. Great nerve strain and shock have repeatedly been shown to affect the development of cancer, and the enormous nerve strain of modern life seems to be effective, both through metabolic derangement and by direct action on living cells. While it is impossible to explain just how disordered metabolism induces cancer genetic changes in cells, it is no more difficult to believe that it does so than it is to understand the intrinsic cause of arterial degeneration, bone changes, obesity, etc., which are recognized as due to metabolic derangement. The spontaneous disappearance of cancer, as occasionally reported, shows that conditions of the system may arise which are antagonistic to carcinosis. Finally, the complete removal of cancer lesions, in various localities, by most careful dietary, hygienic and medicinal measures alone, without surgery, x-ray or radium, as has been repeatedly reported, shows that there is a constitutional basic cause, of which the local lesion, which we call cancer, is but the *product*.

Relation of the Lymphocyte to Cancer. During the entire fetal life which involves characteristically rapid growth and multiplication of body cells and tissues, the lymphocytes remain the most numerous of the white cells: indeed, a relative increase or lymphocytosis persists during early childhood, the period of continuously rapid growth. At the time

⁷ Journal of the Medical Society of New Jersey, 1919, xvi, 111.

when body growth has reached its maximum, a definite change is found in the relative number of white cells in the blood. the number of lymphocytes being very much less than that of the polymorphonuclears, while at the same time the special auxiliary lymphoid tissues (such as the thymus) which have had to do with growth, rapidly atrophy. It appears, therefore, that the lymphocyte possibly may be described as the male cell of the blood, and that through a process which is as yet not thoroughly understood, it has the power by means of the enzymes of its mass of nuclear material to energize the body cells with which it comes in contact, causing them to grow and divide. It is probable that the lymphocyte or its energy substance, is under the constant control of an antibody, and that under normal conditions the influence of the lymphocyte and its enzymes is regulated for the exact demands of the body cells and tissues in their regular growth and division, or to meet the special requirements of increased local repair at points of injury. Reasoning along these lines, it is the belief of Bristol³ that, as the controlled lymphocyte may be the potential father of normal body cells, so the uncontrolled lymphocyte may be the potential father of the tumor cell. The potential mothers of tumor cells are the epithelial cell, the connective tissue cell, the muscle cell or other tissue cells. The offspring of such unions may be the tumor cells themselves—the cancer cell, the sarcoma cell, and the myoma cell. The primary basis of cancer probably is a cell or tissue injury due to various physical, chemical, parasitical, mechanical or metabolic agents. The action of such agents may be just as certain, even though they are not seen and appreciated. Because there is no history of cell or tissue injury, is no reason to doubt this important precancerous factor. Local injury is followed by local inflammation, and the latter involves the concentration of defensive polymorphonuclears and large mononuclears which attack the agents of injury, and also involves the concentration of the offensive lymphocytes with their energy-bearing enzymes, which may stimulate the surrounding tissue cells to more rapid proliferation and repair. It is significant that the lymphocytes are usually more concentrated at the periphery of a lesion. They are apparently more in contact with and more concerned in the repair work of surrounding tissue cells than in the attack on injurious agents: that is, they are seldom, if ever, phagocytic. Thus cancer may be due to two factors, one local, the other general—a local cell stimulus which is set up by the energy-bearing lymphocytes concentrated by any form of local injury (usually chronic); and a general loss of lymphocytic control due to an acquired or possibly hereditary lack of antibodies in the tissues or circulation. Hence, cancer may be the result of an autoparasitism, in which local accumulations of uncontrolled lymphocytes are the important factors. The prevention and cure of cancer possibly may be brought about by the active or passive increase of the controlling lymphocytic antibodies.

Tuberculosis and Cancer. The theory prevailing among the majority of physicians for a number of years and still prevailing among a few,

³ Journal of the American Medical Association, 1919, lxxii, 1048.

that tuberculosis and malignant neoplasms are antagonistic, has not been borne out by facts, according to Broders⁹ of the Mayo Clinic who has devoted his attention to a consideration of this subject. He states that the fact that some tissues or organs are, to a certain degree, immune from one or the other or both of these diseases does not prove that the two diseases are antagonistic. If the observations of Naegeli are correct in which he showed that in 93 per cent. of 420 necropsies on adults more than eighteen years of age, either active, latent or healed tuberculosis had been present, then it is reasonable to believe that similar findings should prevail in an equal number of persons who have died with malignant neoplasia. Furthermore, it would seem that the reason that pathologists are not finding tuberculosis more frequently at necropsy in persons who have died from malignant neoplasms is that the pathologists are satisfied to find the malignant neoplastic condition, and therefore fail to make a thorough search for tuberculosis. Since the surgical pathologist's examinations are limited to the tissue removed by the surgeon, he is greatly handicapped in the search for the two conditions associated, while the pathologist doing a necropsy has access to a large part or the whole of the body. The fact that active tuberculosis occurs most frequently in persons under forty-five, and malignant neoplasia, especially epithelial tissue malignant neoplasia, most frequently in persons over forty-five, does not prohibit the association of latent and healed tuberculosis with malignant neoplasia, and, as a matter of fact, in the series of 20 cases that Broders studied, the two conditions were associated in the same microscopic field seven times (35 per cent.).

Magnesium and Cancer. There has appeared recently an article wherein the author suggested the administration of magnesium salts to cancer patients who have undergone operation in order to lessen the chances of recurrence. It is fortunate that experimental cancer research permits such suggestions as these to be examined in the laboratory, for the clinician's obligation to save human lives imposes on his investigations a restriction that does not hamper the experimental pathologist. A very interesting and searching investigation along this line has been conducted by Itami¹⁰ working under the George Crocker Special Research Fund, yet the intravenous injection of magnesium chloride in doses of from 0.003 to 0.007 gm., an amount which is relatively five or eight times larger than the toxic dose for man, was without effect on two mouse tumors, even when two or three treatments were given within a few days. This was also the case when medication was begun within twenty-four hours after introduction of the tumor graft—that is, before it had become vascularized and at a time when it was therefore most vulnerable. Spontaneous neoplasms, also, pursued their course quite uninfluenced by the treatment. Not only were no tumors cured in 175 animals, but in one mouse which was being injected with a view to preventing, if possible, the recurrence of a spontaneous neoplasm previously extirpated, a secondary growth appeared about three weeks after the eighth injection: furthermore, a new spontaneous tumor arose during the treatment.

⁹ Journal of the American Medical Association, 1919, lxxii, 390.

¹⁰ Ibid., 934.

Both the recurrent and the new tumor must have consisted at first of a small group of cells: yet even these growths, which might be called incipient, were entirely untouched by magnesia. Needless to say, all the tumors concerned in the experiment were submitted to microscopic examination, in order that their carcinomatous nature might be proved. Since carcinomas of the mouse are quite comparable to those in man, arising in animals that have passed middle life, invading the surrounding structures, metastasizing by both blood and lymph channels, and ultimately destroying life, these experiments cast serious doubt on the value of magnesia in the treatment of human neoplasms. In fact, the assertion may be ventured that this element will prove to be useless.

Carcinoma in a Very Young Woman. To those who believe that cancer of the cervix only occurs in middle aged women, the following case which has been reported by Stein¹¹ will be of interest. A young woman twenty years of age, who had had two children and one miscarriage, complained of bleeding profusely and constantly. Four weeks previously, she had been curetted by another physician and her condition was diagnosed as uterine colic. Upon introducing a speculum into the vagina, a large irregular, cauliflower-shaped mass originating in cervical tissue was found, which was extremely soft and bled upon the slightest touch. With much difficulty the uterus and adnexa were removed, but the involved iliac glands were left behind as the condition of the patient did not warrant the prolongation of the operation which would have been necessary to remove them. When the specimen was opened, it was found that the carcinomatous growth was about the size of a child's fist, originating in the anterior cervical canal and had practically destroyed the whole anterior lip. Microscopic examination showed a papillary zone of acini of polyhedral epithelial cells which are invading the surrounding tissue in all directions. In these cells mitotic figures are common, as are areas of necrosis and hemorrhage and, altogether, the picture was one that unquestionably was carcinoma.

Cystoscopy in the Diagnosis of Cervical Cancer. Cruet¹² analyzes what has been written on this subject in different countries, saying that there are now 500 cases in which the cystoscopic findings have been recorded with cancer of the cervix. His own experience with 10 operable and 17 inoperable cases confirms the general opinion that simple bulging of the floor of the bladder has no diagnostic significance. When the floor is thrown up into folds, with deep valleys between, we can count on there being tight inflammatory adhesions which will hamper the operation on the cancer, but do not contra-indicate it absolutely. When there is edema of any kind, there are usually extremely close adhesions, possibly of a malignant nature, which render the operation dangerous and, he thinks, stamp the case as inoperable. The majority of writers report that they never had any difficulty in operating when the cystoscopic findings were negative, but invariably, when they were positive. However, there is no agreement between them as to what constitutes positive

¹¹ American Journal Obstetrics, 1919, lxxix, 413.

¹² Revue mens. de gyn. d'obst. et de péd., 1919, xiv, 3, by Journal of the American Medical Association.

findings. Cruet regards the aspect of the mouth of the ureter as suggestive when it is pushed up or to one side by the bulging of the bladder floor. The ureter mouths may be surrounded by abnormal vascularization, diffusely red, with edema, but the most characteristic findings are the enlargement and flattening out of the orifice, suggesting stenosis just above, and the edematous protrusion of the ureter mouth. This protrusion may give it a volcano-like aspect. When the ureter is compressed, the interval between the spurts of urine is longer and the jets stronger. In normal conditions the intervals are of equal length with both ureters. Compression is also liable to induce spasm of the mouth of the ureter, fractioning the ejaculation. Cruet also noted that when the ureter had been invaded there were no folds in the bladder mucosa around the ureter mouth after ejaculation. Catheterization of the ureter may also give useful information and it may aid in the operation to leave the catheter in place.

Diagnostic Incision of Tumors. The procedure of excising a small fragment of a tumor for examination has long been employed by the dermatologists as a means for obtaining a definite diagnosis; but among the surgeons, opinions are not generally in accord, and of late years the practice of diagnostic excision has been subjected to much criticism, some of it entirely from a theoretical point of view, and some based on a moderate number of cases in which such incision was supposed to have incited the tumor to more rapid growth, or to have led to more widespread metastasis. In order to determine experimentally the exact amount of harm that may be done by removing a malignant tumor, or a part of one, Wood¹³ inoculated 673 white rats with the Flexner-Jobling rat carcinoma and then divided them into three groups. From those in group 1 a portion of each tumor was excised aseptically, and the skin was then sutured over the wound. After ten to twelve days, this being the maximum time required to obtain a microscopic diagnosis, the entire tumor was carefully excised in order that the formation of metastasis might be checked. The animals were killed and examined in from three to four weeks later. From the second group of animals, inoculated at the same time, the tumors were removed on the same day that the tumors were removed from group 1, and the animals were killed and examined from three to four weeks later. This group thus formed a check on the first, for if the number of metastases was the same in both series, it would be evident that the incision of the tumors had not increased the amount of metastasis, since in both series the tumors had been in the animal body for exactly the same length of time and had been removed by exactly the same method. Great care was taken with the surgical technic, so as to avoid massaging the tumors, which, as Tyzzer has shown, and as more extensive experiments in Wood's laboratory have also demonstrated, is a most efficient means for distributing tumor particles throughout the body. The third group of inoculated animals was killed at the same time that the others were killed, and formed a check on the metastasizing power of the tumor. The results of these

¹³ Journal of the American Medical Association, 1919, lxxiii, 764.

experiments showed that the average percentage of metastases in all the animals of group 1, in which probatory excision was made, was 22.2. The average of metastases in the animals of group 2, in which the tumors were removed without previous incision, was 21.8. In the animals in group 3, which were allowed to go without any operative procedure, the percentage of metastases was 32.2. These figures include metastases in the lungs and in the axillary, superior mediastinal, and peritoneal lymph-nodes. Control series 3 shows that the frequency of metastasis is a function of the time that the tumor remains in the body, and again emphasizes the well-known fact that a malignant tumor should be removed as soon as possible after the diagnosis is made. A similar experiment with the Crocker Fund rat sarcoma number 10 on 384 animals also showed no increase in metastasis as a result of the incision of the tumor. Wood believes that it is evident that this experiment demonstrates that in white rats bearing the Flexner-Jobling rat carcinoma or the Crocker Fund rat sarcoma number 10, metastasis is not increased when the tumor is incised, a fragment removed aseptically, and the growth allowed to remain in the animal for from ten to twelve days thereafter. It permits the deduction, also, that human tumors are probably not widely distributed by incision as has been thought, and that, therefore, when these tumors are situated in such portions of the body that a mutilating or highly dangerous operation is necessary for their removal, they should be examined microscopically *if a diagnosis can be made in no other way*. It is preferable that such diagnosis be made immediately by frozen section, if facilities are available, so that, if necessary, the operation can be continued under the same anesthesia; but the patient's future is not necessarily compromised if a small fragment is removed, the wound closed, and the operation proceeded with the moment a microscopic diagnosis is obtained. With modern rapid methods of preparation of sections, the lapse of time need not be more than three or four days.

Radiotherapy. During recent years an increasingly conservative attitude in the treatment of cancer of the cervix uteri has been adopted in many of the large clinics, according to Janeway¹⁴ who is head of the radium department of the Memorial Hospital of New York. Cancer of the cervix uteri, as regards its amenability to surgical treatment, contrasts strongly with cancer of the fundus. The latter can be successfully removed in a large percentage of cases without exposing an otherwise normal individual to a serious risk, while the mortality after an adequately planned operation for cancer of the cervix is high and the percentage of cures disappointingly low. During the last five years of the past century, the low percentage of cures produced by vaginal hysterectomy was generally recognized, and the extended abdominal operation adopted by the more important operators. Wertheim has earned the credit of perfecting the details of this operation, having published his description in 1898. His operation represents the widest removal of carcinoma of the cervix. In experienced hands it has given

¹⁴ Surgery, Gynecology and Obstetrics, 1919, xxix, 242.

a generally considered high percentage of cures, based on a freedom from recurrence of three to five years. The percentage of cures in any series of cases is, however, dependent upon the favorable character of the cases selected for the operation, and the radical nature of the operation to which the patient is exposed. Thus we find that the most favorable statistics of cures accompanies, as a general rule, a low percentage of operability and a high primary mortality.

Janeway has prepared several tables in which he has combined the report of Jacobson, which we¹⁵ quoted several years ago, with reports from additional operators which are more recent. A summary of these tables shows that of 5027 cases of carcinoma of the cervix removed by the radical abdominal operation, 1720 or 34.21 per cent. were operable. Of 1997 cases there was a mortality of 364, or 18.23 per cent. Of 1090 cases there were 386 cures (with few exceptions of five years' standing) or 35.41 per cent. of traced cases, or 19.32 per cent. of cases operated on, or less than 11.72 per cent. of cases applying for treatment. Carcinoma of the cervix removed by the vaginal method: Of 1305 cases, 654, or 58.1 per cent. were operable (Schauta). Of 727 cases there was a mortality of 68, or 9.35 per cent. Of 647 cases there were 192 cures (five years' standing) or 29.67 per cent. of traced cases, or 17.74 per cent. of cases operated on, or less than 11.72 per cent. of cases applying for treatment. Carcinoma of the fundus of the uterus: Operability, 76.47, or 97 per cent., average 86.73 per cent.; mortality, 20 of 244 cases, average 8.19 per cent.; cures (five years' standing) 148 of 242 operations, average 61.15 per cent. or 53.03 per cent. of cases applying for treatment.

If we accept Wertheim's conclusions that carcinoma of the cervix is twenty times as frequent as carcinoma of the fundus, it is possible to calculate on this basis the combined percentages for operability, mortality and curability of cancer of the uterus, *i. e.*, including both cancer of the fundus and cancer of the cervix, by multiplying the percentages for carcinoma of the cervix by twenty, adding to the product the percentages for carcinoma of the fundus, and dividing by twenty-one. Using this method, the operability of carcinoma of the uterus is 37.61 per cent.; the mortality is 17.74 per cent.; the curability based on the five-year standard for traced cases, is 36.63 per cent.; for cases operated on, 21.31 per cent.; for patients applying for treatment 9.82 per cent.

A review of these tables indicates at first glance that the operative statistics, more certainly in the case of cancer of the fundus, but even for cancer of the cervix, are not unfavorable to this method of treatment. When, however, certain facts are considered in connection with these figures, the operative treatment of cancer of the cervix is far from satisfactory. In the first place, while the immediate mortality in the most skillful hands is only 10 per cent., it is still 20 per cent. in skilled hands, and in the hands of even Wertheim, during the period of the development of his operation, in his first 100 cases, it was 30 per cent. Such a high mortality restricts the usefulness of the operation to relatively few surgeons, entirely inadequate to meet the demands of a large

¹⁵ PROGRESSIVE MEDICINE, June, 1917, p. 178.

number of patients having cervical cancer. Nor does this high mortality tell the whole story. It leaves out of consideration entirely, first, the necessity for restricting the operation to a small percentage of the most favorable cases, and, second, the suffering entailed by the operation itself and its sequellæ. The majority of these postoperative sequellæ are, of course, temporary, but a sufficient number are permanent to constitute a real objection to the operative treatment of cancer of the cervix. These various unfavorable complications of the operation, the high mortality after an operation which is at all adequate, the by no means infrequent and unpleasant postoperative sequellæ, and, finally, after a woman has faced all these risks, not to mention the discomfort of the operation itself, the rather small prospect that she will be permanently cured, that she will not be obliged to suffer a lingering and painful death, has caused many of the most prominent gynecologists to adopt a more conservative attitude toward the radical abdominal operation for cancer of the cervix.

Having thus detailed his opinion on the subject, with which the author fully agrees, Janeway presents the results that he has attained in cases of *cancer* which he has *treated by* means of *radium*. These cases, 30 in number, have a post-therapeutic period, varying from $3\frac{1}{2}$ years to six months, and comprise 17 carcinomata of the cervix, 4 recurring carcinomata of the cervix, 4 carcinomata of the fundus, and 5 carcinomata of the vulva (labia minora and clitoris). Of the 17 carcinomata of the cervix, the post-therapeutic period in one is $3\frac{1}{2}$ years, in another three years, and in a third $1\frac{1}{2}$ years. Nine of the remaining cases, all treated within the past year, have undergone the same continuous retrogression after a single treatment, as the first three cases treated with the longer post-therapeutic period. Five of the 17 carcinomata of the cervix have recurred after the first treatment and are again under treatment. The fact, however, that they have developed a recurrence is deemed a very unfavorable factor in their ultimate prognosis. In 2 of these cases a large portion of the vaginal wall was involved. Two others had bad symptoms of bleeding for many months before the radium treatment. The remaining case having a very advanced lesion, has been treated recently and is still under observation. All four of the cases which developed recurrence showed a primary retrogression which was complete for a short period in 2 cases and became almost complete in the other two. In all four of these cases the recurrence or renewed growth developed within four months from the time of the first treatment. The fifth case is still improving but was so extensive at the time of treatment that a cure is not expected. Of the four patients with carcinoma of the fundus, one, an old lady, died of intercurrent disease two years after the radium treatment. She never had any return of her uterine symptoms. A second patient remained in perfect health for two years from the time of her first treatment. The third patient, treated $1\frac{1}{2}$ years ago, and the fourth patient, treated within the past year, are still free from symptoms. Of the four recurrent cases, one patient treated first two years ago, is still free from any evidence of disease. Another, first treated a year ago, is free from evidence of disease. A third, treated two years ago, has recently required another treatment and at present shows

symptoms of metastasis in the upper pelvic glands. The fourth case was not improved.

For cancer of both the fundus and cervix, Janeway recommends the use of three tubes containing 150 milligrams of radium and inserted in the uterocervical canal, arranged end-to-end in a long rubber tube. For cancer of the cervix three additional tubes are placed against the cervical ulcer. The tubes placed against the cervical ulcer should be distributed evenly over its surface and the best method of retaining them in such a position, is by embedding them within a mold of the cervical ulcer and vagina made of dental modeling compound. The dosage which he has found safe and efficient in cancer of the cervix, the radium being distributed as above described, is 6000 millicurie-hours, *i. e.*, divided into 3000 millicurie-hours within the uterus and 3000 millicurie-hours against the cervix, in other words, it is recommended that the radium should be divided into six tubes for the treatment of cervical cancer and, if each tube contains 50 milligrams, three of the tubes arranged end-to-end are placed in the uterocervical canal for twenty hours and the other three against the cervical ulcer for the same length of time. A review of the cases recorded in this paper does not, of course, prove that radium is, at the present time, the method of choice for treating primary carcinoma of the fundus or cervix uteri. Taken, however, in conjunction with the other reports in literature, it suggests that in only a few years there will be ample proof that radium is the method of choice in the treatment of cancer of the uterus, at least of that most frequent form of cancer of the uterus and most difficult to manage by operation, cancer of the cervix.

Boggs¹⁶ reminds us that several factors have brought radium into disrepute and have given the impression that the claims made were unjustified. Chief among these is allowing patients and the physicians who refer them to us to expect a permanent cure when only palliation and prolongation of life is all that anyone with ordinary medical intelligence could expect. The patient often cannot receive much palliation from any other method of treatment, but by the use of radium will improve rapidly for a time, or even a clinical cure will be obtained. Finally, on account of the extensive metastases, the patient will die after from six months to three years or more of prolongation of life. Then those who were watching the case or those who knew that radium had been used will decide that radium had no value, without remembering or knowing the condition of the patient when radium was started. If one is to express an opinion as to the therapeutic value of a remedy, such statements should be guarded unless a study of all factors has been made and one should be without prejudice for or against the remedy. Many operators have used insufficient quantities of radium, thus giving inefficient dose, or else, on the other hand, have overtreated the local growth, without attempting to treat the metastases. No one will deny that, under certain circumstances, radium may be harmful rather than beneficial, since if the dose is too small or too long continued, stimulation rather than destruction may take place while, on the other hand, too

¹⁶ New York Medical Journal, 1919, cix, 488.

large a dose may result in irreparable damage to normal tissues. Treatment of hopeless carcinoma in the past has been with morphine, but today, Boggs believes that it should be by radiotherapy since it is pitiful that patients with inoperable cancer, after their condition is pronounced hopeless, receive so little consideration. However, he cautions that thorough knowledge of the action of radium is essential, because from that knowledge only may the proper dose be applied to produce the best results, and the haphazard use of radium should be discouraged. In estimating the value of radium therapy, its advocates do not claim that it supersedes surgery, but that it is a valuable adjunct to surgery, in helping to prevent recurrences after operation and in rendering inoperable cases operable and that it has proved itself one of the best palliatives we have in cases in which operation is impracticable and in many of such cases has brought about an apparent cure. In recurrent and inoperable carcinoma of the uterus, Boggs believes that radium might be considered the specific treatment, because it is the only method which retards the process to the same extent and gives the same amount of palliation. Radium is always less valuable in recurrent than in inoperable carcinoma of the uterus and since so much has been accomplished in the inoperable cases, in every primary case, no matter how early the operation has been performed, Boggs believes that there should be either ante- or post-operative treatment with radium, or both.

Bailey¹⁷ has conducted nearly two years of work with only small quantities of radium at his disposal and he has reached the conclusion that the problems confronting the man possessing the small amount of radium salt are essentially different from those presented to the holder of several grams. With the small amount, in order to produce any effect at a distance from the applicator, it is necessary to leave the radium in position for such a length of time that there is a local necrosis. This is a serious affair because of the proximity of the bladder, rectum and ureters. In treating malignant conditions the possessor of 100 or 200 milligrams of the salt would do well, at the present time at least, to confine himself to the palliative treatment of inoperable and recurrent cancer and to the preoperative treatment of operable cancer. From January, 1915, to May, 1919, a period of 4½ years, Bailey treated 356 cases of carcinoma. Of this number there were 20 cases that did not complete the treatment or were lost following the treatment. Three of these died following the first application, while 14 were given but one application and failed to return. Three had the full treatment but did not return. This leaves 336 cases upon which the statistics of his report are based. Of this number there were 190 cases termed primary, that is, in which no operative procedure had been undertaken, except perhaps in a few cases a mild cauterization or curetting; 106 cases were recurring cancer after a hysterectomy. Twenty-nine cases were treated after a Percy cauterization or an operation of the Percy type.

As a result of experience with such types of cases as above outlined, Bailey has come to certain definite conclusions regarding the *indications for radium application*. The most advanced cases frequently present

¹⁷ American Journal of Obstetrics, 1919, lxxx, 300.

a massive growth involving all of the pelvic organs, but with little or no ulceration in the vagina. This is especially true of the recurrences. In such cases an application of radium can hardly do more than cause some slight diminution in size, with possibly local sloughing, and the patient's condition cannot be said to have improved; in fact, it eventually becomes worse than before and considerably more painful from the contraction of the tissues and the pressure upon nerve endings. Another type of the very advanced cancer is the ulcerating type, usually primary, with a deep cervical crater having undermined edges, so that the rectum and the bladder are in immediate proximity or are involved in the growth. Treatment will relieve or partially relieve, for a time, the sloughing and discharge, but will almost invariably produce a fistula in the bladder or rectum earlier than it would otherwise occur. Advanced cases in which the parametrium is deeply involved in one or both sides, providing that they are primary so that the cervix offers a location for the radium that is approximately in the middle of the tumor, are not infrequently greatly benefitted, even to the extent in two instances of being free from the signs of the disease for considerable periods. The most that can be expected is the healing or partial healing of the local lesion, with consequent disappearance of bleeding and discharge and some retrogression in the size of the parametrial involvement. Not infrequently the further extension of the growth is behind the vaginal wall. The palliation is often so great that the patient gains in weight, has a good color and enjoys a longer lease of life in comparative comfort than did those patients who, prior to the use of radium, had only the benefits of curettage or cauterization. Usually within a year a relapse occurs and the case slowly progresses toward the end. The last months are apt to be very painful, due to the general fibrosis throughout the pelvis, but there is little or no discharge. It is amazing how long patients will live in a condition of this kind, and even though they develop rectal fistulæ they remain clean by careful attention to the bowels. Experience shows that in this class, even though there is some question of the beginning involvement of the bladder wall, a complete and deep raying of the entire lower pelvis gives the woman the greatest prolongation of life.

The *border-line cases* by universal agreement most properly fall into the radium field. Here the lesion advances a short way into the parametrium on one or both sides, to an extent that is determined with difficulty, but the uterus is held somewhat by the indurated tissue or the lesion of the cervix is not deep but overlaps to some extent upon the vaginal wall. In this class the most amazing results are accomplished by radium for it renders most of the cases operable and produces in nearly all the disappearance of cancer cells in the local lesion. There are in Bailey's series seven uteri that were removed following radiation in which the pathological picture upholds the latter statement, for in none was there found any cancer of the cervix. Of 17 cases that fell into this class in 1918 and were treated with radium alone, 5 died of cancer and 8 are in poor condition. There are 4 in this group that are in good condition and might have some prospects, although they cannot be said to be free of all clinical evidence of the trouble to date.

In the *operable cases*, one of the three procedures may be adopted: The uterus may be left *in situ* and massive radiation conducted through the parametrium, a simple hysterectomy may be done followed by radiation, or a radical operation may follow the complete or incomplete raying of the pelvis. The operable carcinoma of the *body* of the uterus is such an indeterminable thing from the standpoint of judging its extent that treatment with radium alone is seldom justified. The flat cancer extending over most of the mucosa and involving the wall in certain areas can hardly be expected to resolve from the blind insertion of radium into the uterine cavity especially if the uterus is considerably enlarged. The prophylactic treatment following the removal of a tumor offers a field in which a great deal may be accomplished, provided the operator does not remove most of the vagina, as this cavity gives the only practical entrance for the radium applicators. Early recurrent cancer following hysterectomy treated by massive doses and by cross-fire have resulted, in a number of cases, in complete retrogression, and in numerous cases with a prolongation of the patient's life.

GERMAN STATISTICS. It has been several years since we have had any reliable statistics on radium therapy from Germany and therefore the report and conclusions of Bumm¹⁸ who is the professor at the University of Berlin, are of interest. Between the years 1913 and 1915 he subjected 401 cases of genital carcinoma to radiation with mesothorium or radium and in the three to six years that have since elapsed he has had ample opportunity to study the end-result. Before presenting his views on the subject it is worth while to review the accompanying tables that he had presented.

		1913			
Type.		Number.	Cured.	Cured, per cent	
Cervix,	operable	14	4	28.5	
	borderline	22	5	23.0	
	inoperable	42	2	4.7	
Fundus,	operable	1	0		
Vagina,	operable	2	1		
	inoperable	7	0		
Urethra,	operable	1	1		
Vulva,	operable	1	1		
Recurrences after operation		25	0		
		1914			
Cervix,	operable	20	4	20.0	
	borderline	21	4	19.0	
	inoperable	36	2	5.5	
Fundus,	operable	3	1		
Vagina,	inoperable	5	0		
Vulva,	operable	7	3		
Urethra,	operable	2	2		
	inoperable	2	0		
Recurrences after operation		37	5	13.5	
		1915			
Cervix,	operable	40	22	55.0	
	borderline	38	15	39.0	
	inoperable	49	5	10.0	
Fundus,	operable	1	0		
Vagina,	operable	4	2		
	inoperable	4	2		
Vulva,	operable	5	0		
Recurrences after operation		12	0		

¹⁸ Zentralbl. f. Gyn., 1919, i, 1.

The operative mortality in cancer of the cervix when the radical operation was employed in 203 cases in the clinic of Bumm from 1911 to 1915 was 13.8 per cent. Of 157 cases operated upon between 1911 and 1913, 77 were well after from six to eight years, which means a cure of 49 per cent. Comparing this to the cases treated by radium, we see that the percentage of cures after radium in operable and borderline cases of carcinoma of the cervix is one-third less than after operation at the end of six years. When the cases are only observed over a period of three years the results of radiation surpass those of operation in cervical cancer, since 55 per cent. of the operable cases remained well. It has been stated that recurrence of carcinoma after it has been healed by radium will occur within the first year if it is going to occur at all, but Bumm has found this to be wrong, as he has had many recurrences after one, two and three years. There were 22 cases of carcinoma of the vagina in this series of which 22 per cent. were healed at the end of three years, which is a better result than is found after operation. Of 13 cases of cancer of the vulva, 9 have already died of recurrence. Of the 5 cases of urethral cancer that he treated, 3 have remained well, a cure of 60 per cent. Bumm states that in general the soft medullary cancers are more easily influenced by radiation than the hard growths and adenocarcinomata, but every case is different as regards treatment and no standard dose can be stated for all cases. As a result of his work he concludes that it is not proper to treat all genital carcinomata by radiation. Cancer of the mammary gland, vulva and ovary should be operated upon and then subjected to radiation. Likewise cancer of the fundus should be operated upon when the condition of the patient permits. On the other hand, all cancers of the vagina and urethra should be radiated instead of operated upon. In cancer of the cervix, he prefers operation when the case is early and the patient in reasonably good condition. In cases in which operation is contra-indicated on account of age, general condition, heart or bloodvessels, radiation should be resorted to.

Effect of the X-ray on Carcinoma in Vitro. Some experimental work with mouse tumors has been performed by Kimura¹⁹ to determine the effects of x-ray irradiation on living carcinoma and sarcoma cells in tissue cultures *in vitro*. In the course of the research, it was found that mouse carcinoma and sarcoma grow as well in guinea-pig plasma to which has been added mouse serum diluted with Ringer's solution as in mouse plasma itself and the outspreading growth of cells in culture, both sarcoma and carcinoma, was not stopped by x-ray action varying from E 4 to E 12. The mitotic figures of cells were limited to a minimum after an exposure of E 8; after an exposure to E 12 however, they disappeared entirely and the treated tissue produced no tumor when inoculated into mice. The growing power of sarcoma after E 4 exposure was stimulated to some extent while carcinoma was not appreciably influenced. After an exposure of tissues to E 12, both sarcoma and carcinoma, the growing power of these tissues was stopped when inocu-

¹⁹ Journal of Cancer Research, 1919, iv, 95.

lated into mice, and eliminated the process of mitotic division of cells. The process of oxidation of tissues, both sarcoma and carcinoma, was stimulated by the x-ray action of E 4 and retarded by exposure to E 12 of the ray. The terms E 4, E 8, E 12 indicate that the Hampson's pastille used showed number 4, number 8 or number 12 tint, that is, equivalent to a dose $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ of Sabouraud's B tint.

Combined Methods of Treatment of Carcinoma. At least four methods have been proved to be of distinct and positive value in the treatment of malignant disease. Each method can claim many successes to its credit, but the profession and the laity know well that each has also many failures. It is with the hope of influencing the profession to combine one or more of these methods in the treatment of malignant disease that Pfahler²⁰ has presented this subject, for he believes that whenever additional help can be obtained from another method, or more than one, that the patient is entitled to this advantage. By certain skillful combinations, he is sure that many cases which now are ultimate failures may be made successes, and in this way advance be made in the treatment of this dreaded disease. The four methods which stand out most prominently in his mind are surgical excision, electro-coagulation, roentgen therapy and radium therapy. Surgical excision needs no explanation. It can be used anywhere, but, to be effectual, must be used early and the dissection must surround the disease or failure will result. In every case in which the malignant disease is excised surgically, such excision should be followed as soon as possible by thorough roentgen therapy, and sometimes radium therapy can be added to advantage.

With electrothermic coagulation, as the name implies, there is produced a coagulation of the tissues by means of heat, the heat being generated by the electricity. It differs, however, from the thermocautery for the removal of the disease, in that the heat is generated in the tissues and is produced by the resistance to the flow of the electricity through the tissues, while the thermocautery destroys by transmitted heat and necessarily produces a more superficial effect. The advantages of electrothermic coagulation are that the disease is destroyed by conducted heat which gives a zone of devitalization without actual destruction of healthy tissue, thereby saving local tissue when necessary. There are no fresh bleeding wounds in which to permit the transplantation of malignant cells. There are no blood or lymphatic vessels opened up through which the disease can be disseminated during the operation. One does not have hemorrhage to contend with, though in tongue cases there is some danger of secondary hemorrhage. There are no open wounds and no danger of local infection. On the other hand, the disadvantages of electrothermic coagulation are that there is complete destruction of all the tissues between the two electrodes: Therefore, there is no chance of saving the blood vessels or nerves which are in close proximity to the disease. There is necessarily considerable sloughing and foul odor associated during the first two or three weeks, but there is

²⁰ Pennsylvania Medical Journal, 1919, xxii, 307.

no danger of infection, and Pfahler has never had infection of the tissues develop in any case of electrothermic coagulation in any part of the body.

Generally speaking, the effect of radium therapy is identical to that obtained by the roentgen rays, providing that the two agents can be used in equal amount and equally well. The advantages of the roentgen rays consist in the fact that one can apply approximately a million times as much radioactive effect in the same period of time, granting that the case is suitable, and that the rays can be applied externally. The advantages of the radium, however, consist in the ability to apply the radiation within cavities or in locations in which much energy would be lost in overlying tissues before reaching the diseased area. It also has the advantage of being applied with less technical skill. The third advantage consists in the fact that it can be applied for a considerable period of time without continued attention on the part of the physician, and almost without the knowledge or inconvenience of the patient. Its greatest field of usefulness, however, is in the treatment of disease within cavities such as the mouth, the vagina, the uterus, the rectum, the bladder, the esophagus, etc. In all of these cases, however, one should use the radium for its radioactive effect within the cavities and extensive cross firing can be obtained by means of the roentgen rays. In this way the two agents supplement and support each other, and one doubles the effect. In other words, by using radium in this manner, one obtains an additional cross firing effect, corresponding, for instance, to the placing of a roentgen ray tube within the mouth, vagina, bladder or rectum, etc., which is, today, an impractical procedure. Using the two agents conjointly in this manner, Pfahler is sure that more malignant disease can be eradicated, more patients gotten well and with no disadvantage. The fact that we are not always successful in the treatment of malignant disease by any single method is sufficient proof that that method is lacking in some respect. It is with the hope of meeting this condition that the combination of methods is desirable. He believes, whenever practical, that the carcinomatous tissue should first be destroyed by electrocoagulation. When this is not practical because of its location, or because of bloodvessels or nerves in the neighborhood of the disease, or association with glandular disease, then the disease should be excised surgically, and as widely and as far from the disease itself as is practical. No matter which method of direct elimination of the disease is used, deep roentgen therapy should follow on the excised or destroyed area or on the glandular area leading therefrom. In fact, it is desirable in many instances to precede the destruction or excision by thorough roentgen ray treatment.

Benzol in the Treatment of Cancer. Bordarampe²¹ had a case of epithelioma of the uterine cervix which was inoperable and progressing and radiotherapy was not available at that time. As a last resort, he applied a tampon wet with pure benzol directly to the neoplasm leaving it in contact for five minutes and then replacing it with a dry tampon.

²¹ Rev. Asoc. Med., Argentina, 1919, xxx, 237, by Journal of the American Medical Association.

Besides this, two douches were given daily, each with two liters of hot, boiled water containing fifty drops of benzol. The fluid was stirred while the douche was being given. Under this treatment the neoplasm shrank and healed over, and in four months the woman increased ten or twelve kilograms in weight and felt very well. The cancer healed until its operative removal was justified. In a second, similar case, the cancer shriveled to a very small bunch under six months of treatment. Then it began to ulcerate again, its aspect then suggesting a superimposed syphilitic lesion as the Wassermann reaction was positive. Arsenic and mercury were then given, but under this treatment the cancer flared up anew and metastases developed at various points. Seven other patients have been treated since, with permanent success so far as known. Two are still under treatment, one is progressing well but the other has hemorrhages, and no measures seem able to arrest this tendency to hemorrhage.

Chorioëpithelioma. There is probably no more interesting topic in the whole domain of gynecology than that of chorioëpithelioma. An entirely physiological process, by slightly overstepping its bounds, becomes at once a highly malignant condition, with rapid and extensive metastases. Although it is generally associated with gestation, it may nevertheless occur in individuals in whom pregnancy can be positively excluded, as for example, in a very young female, or even in a male. Its development under these conditions, forms a most interesting chapter in pathology. Another curious feature is its occasional development originally in areas more or less remote from the site of the ovular implantation, while this remains free from the process.

Thus prefacing his remarks, Vineberg²² has made a contribution to this subject based upon nine personal cases and upon a close and rather extensive study of the literature. It is generally agreed that there are two varieties of chorioëpithelioma, the one highly malignant, the other, semi-benign, but the consensus of opinion at the present time is that there are no definite histological features characterizing the one variety from the other.

The most characteristic and prominent symptom of this condition is uterine hemorrhage, which, as a rule, is very profuse and may be alarming. However, in many instances the bleeding may be only of moderate amount, but protracted, simulating that which accompanies ordinary placental or decidual residue. As a rule, the patient is subjected to a curetting but it is found that the bleeding soon recurs. This of itself should excite suspicion, but it is not uncommon to read in the literature of cases that had been subjected to as many as five or six curettages before the condition was suspected. The persistent, and at times very abundant, bleeding soon leads to marked anemia, with its train of symptoms, cachexia becomes manifest, the patient feels and looks ill, and a septic condition may intervene. As the tumor grows, it may perforate the uterus, in which event there may be a most profuse intraperitoneal hemorrhage, simulating ruptured tubal pregnancy of the tragic type.

²² Surgery Gynecology and Obstetrics, 1919, xxviii, 123.

Hemoptysis, when present, is an important sign and may manifest itself comparatively early in rapidly advancing cases, usually indicating the presence of pulmonary metastases. In many cases an early evidence of the disease is the appearance of characteristic tumors in the vaginal walls, most frequently in the anterior wall, near the urethral meatus. The uterus is usually found enlarged, the degree of enlargement varying from that corresponding to the gravid organ at six weeks to that of twelve weeks. The cervical canal may be patulous, readily admitting the index finger, thus permitting an exploration of the cavity, and the growth can then be felt as a hard nodule of variable size, with a distinct excavation in the center. If it can positively be concluded that the excavation had not been artificially produced by a previous curettage, one is safe in making the diagnosis of chorioëpithelioma.

Metastases from this tumor have been observed in nearly all the organs, gaining entrance by way of the blood current. Most commonly a fragment of the neoplasm enters the blood current, passing through the heart, and arrives in the lungs where it is disseminated to all the organs, but in the case of the organs in the genital sphere, the metastases reach them through the venous anastomosis of the pelvic organs. Metastases in the lungs are most frequent and their number and size vary very much. Occasionally only one tumor is found which may acquire very large dimensions, or, more frequently, numerous small nodules are found scattered over the entire lung, the most favorable site being the apices and the bases. Next to the lungs the vagina and vulva are the most frequent sites of metastatic growths and on account of their situation they are the most easily discerned. Occasionally, a single isolated tumor only is present, but more frequently there are numerous small nodules running together, forming almost a ring, and are characterized by their brown or violet color. They have been justly compared to thrombosed varices which they resemble so closely as to be frequently mistaken for them. These tumors grow very rapidly causing necrosis and irregular ulcerations and may be attended with profuse and obstinate hemorrhages. They very soon become infected and give rise to a sanious and fetid discharge. The other regions of the body where metastases are found with more or less frequency are the uterine ligaments, tubes and ovaries, liver, kidneys and urinary passages and central nervous system.

The diagnosis of chorioëpithelioma is often beset with great difficulties. One should always suspect it when profuse hemorrhage follows a hydatid mole that has been thoroughly removed. Vineberg advocates the performance of a hysterotomy in every case of hydatid molar pregnancy, so that the hand may be employed to remove all the vesicles. Another value of this procedure consists in enabling the operator thoroughly to palpate every portion of the inner wall of the uterus for any suspicious nodule or extra thinning of the wall at any one area. In this manner the growth may often be detected in its very earliest stages. There is no form of malignant new growth in which the prognosis varies so widely as in chorioëpithelioma. If the diagnosis has been made early, and the uterus has not been subjected to much manipulation, as is occasioned by several curettages, the prognosis is fairly good.

Different from other malignant new growths, the outcome may be good, even in the face of extensive metastases. Several cases are on record, in which there were evidences of metastases in the vagina and lungs, and the patients recovered with and without operations. The treatment of chorioëpithelioma, once the diagnosis has been made, resolves itself into an immediate panhysterectomy, since we have no means of determining whether the individual case be a highly malignant one or one that might undergo spontaneous cure. The latter contingency is so unusual that for all practical purposes it must be left out of consideration. Vaginal nodules, if present, should be excised and if they occur subsequently, the same procedure might be necessary although they have a tendency to disappear spontaneously. Differing from carcinoma, the lymphatic vessels and glands are seldom involved and there is no indication for doing anything so radical as the Wertheim operation. Furthermore one should not defer operation in the face of the most unpromising local conditions because extensive infiltrations are usually due to venous involvement which has a tendency to disappear spontaneously after removal of the uterus. Even when there are signs of metastases in the lungs, hysterectomy should not be denied, if the patient be in a condition to withstand the shock of the operation, for there are several cases on record in which the lung symptoms have disappeared after the original growth had been removed.

Mesodermal Mixed Tumors of the Uterus. Although this class of neoplasms is very rarely found in the body of the uterus, a number of cases have been reported, but there has been reported in this country no tumor of the uterus which contains cartilage as a heterogeneous component. Therefore the case of chondrosarcoma of the corpus uteri, originating in the endometrium, that has been reported by Perlstein²² is of interest both pathologically and clinically. The clinical history is that of a woman aged fifty-four years, whose chief complaint was profuse bleeding from the vagina at irregular intervals, which she considered as a manifestation of the menopause. Up to the age of fifty-two her menstruation as a whole had been regular and normal, but since then it had been irregular and profuse. She had had a curettage and x-ray treatments without any permanent effect. Upon digital examination on admission to the hospital, a handful of tumor masses was removed, these masses were protruding from the dilated cervix and felt like 'boiled sago.' A radical panhysterectomy was performed and since the operation she has had practically no symptoms and has improved in every way. The pathological report of the specimen calls attention to the fact that the myometrium is soft and flabby and the uterine cavity is filled by a tumor mass which is partly polypoid and partly grapelike and attached mainly to the posterior wall of the corpus. The most conspicuous feature in the microscopical appearance is the large amount of cartilage, which in a large number of the sections is the predominating tissue, and which is found in practically every section taken from the larger polypi and berries. Perlstein states that it is evident that this growth is a

²² Surgery, Gynecology and Obstetrics, 1919, xxviii, 43.

chondrosarcoma of the endometrium. Two kinds of tissue are predominating: Namely, cartilage and a loose connective tissue. In the latter the nuclei are far apart and the tissue is myxomatous in appearance. There are also sarcomatous areas and isolated glands of the endometrial type. Besides the grapelike structure and heterogeneous components of this type of tumor, its great malignancy is one of its characteristic features, which is manifested less by metastases than by local extension and by recurrence after operative removal which often occurs very rapidly. At first they spread on the surface; the deeper tissues are infiltrated rather late. The vaginal tumors seem to have more inclination to infiltrative growth into the deeper tissues than those of the cervix and uterus. Distant metastases are infrequent and late and as a rule do not contain heterogeneous tissue. Clinically it is difficult to differentiate these growths from other malignant tumors of the uterus. The most common symptom is irregular and profuse bleeding; frequently there is a vaginal discharge, which at first is watery or blood tinged, later it becomes purulent and offensive. A positive diagnosis can only be made microscopically and when the diagnosis has been made with certainty, the prognosis is generally considered unfavorable.

NON-MALIGNANT CONDITIONS OF THE UTERUS.

Radiotherapy. The management of the *profuse menstruation* in those cases in which no lesion is found or in cases in which a small myoma is found, has not in the past been especially satisfactory. In some instances young persons respond to glandular medication, such as ovarian and thyroid extract and pituitrin and a few patients have improved after blood transfusion, and following the use of horse serum, but the effect, as a rule, has been that of temporary relief only. Curettement is seldom effective and should be tried only after medical treatment has failed. This type of menorrhagia, in older persons, has usually been treated by local medication and repeated curettements. In many of the cases in which a myoma is found, the conservative surgeon hesitates to submit the patient to so radical a procedure as a hysterectomy or even a myomectomy, and in such cases radium should always be considered.

Stacy²⁴ has summarized the experiences with radium under these conditions as found in the Mayo Clinic where this element has been used since 1915 in the treatment of the menorrhagia of the menopause, in cases which presented no gross pelvic lesion, and in those presenting a fibroid but with contra-indications to operation. Since then the types of cases treated have been increased and now radium is considered the treatment of choice in all cases of the menorrhagia of the menopause in which the presence of carcinoma is definitely excluded, either by history or by diagnostic curettement, and in those cases not presenting a large, soft myoma which is apt to later undergo degeneration. The radium is also used in cases of profuse menstruation of the young woman (1) when there is a small submucous fibroid, (2) when no gross pathological

²⁴ Minnesota Medicine, 1919, ii, 88.

condition is demonstrable, and (3) in cases presenting a large myoma in which there is a definite surgical risk. However, they have not entirely replaced myomectomy with radium for the treatment of myomas in the patients between the ages of thirty and forty years.

Of the 175 patients that were treated with radium from August, 1915 to December, 1917, there were two under twenty years of age, 34 from twenty-one to thirty years, 45 from thirty-one to forty years, 91 from forty-one to fifty years, and 14 were more than fifty years of age. Of this number 93 had had previous curettement, 37 had had more than one curettement, and 56 had undergone other pelvic operations. In 69 cases there were complications that were considered as relative, though not in every instance absolute, contra-indications to operation. There were heart lesions in 34 cases, hypertension in 8 cases, kidney lesions in 11 cases, obesity in 8 cases and pulmonary tuberculosis in 6 cases. Seventy-seven of the 175 cases had definitely palpable fibroids and it is interesting to note that 155 of the 175 cases were married women, and that of these only 25 had not been pregnant.

The dosage of radium is gauged by the age of the patient, and by the presence or absence of the tumor. In the young person without a demonstrable tumor and when it is desirable to continue menstruation, usually one application of 50 mg. of radium element for from four to six hours is used. In older persons in whom it is desirable to stop menstruation entirely, it has been found that an exposure of 50 mg. for from ten to twelve hours has brought about the desired results. In cases in which large dosage is used, menstruation is usually irregular for about two months and ceases entirely after the second or third month. Following the lighter exposures it becomes regular and normal in most instances in about two months. It is the custom in the Mayo Clinic not to repeat the treatment until an interval of three months has elapsed. If, after that time, menorrhagia continues, a second treatment is given and, with the exception of one case, the second treatment has been effective. In this instance menstruation ceased for one year, and then became profuse and the periods prolonged. It has been necessary to give second treatments in 10 instances in this series. In 8 instances a hysterectomy was done later, but only one of these 8 cases had been given a second radium treatment. Included in this series is one case of adenomyoma of the uterus, in which a microscopic diagnosis was made at the time of the exploratory incision, but the tumor entirely disappeared after one intrauterine and four abdominal treatments. Reports have been received from 143 of the 175 patients and in 55 (38.5 per cent.) menstruation had ceased, not to return to the date of the report. In only 14 patients did menstruation cease immediately following the treatment. In 15 cases menstruation ceased for three months and returned, in 29 (20 per cent.) the menstruation became normal; in 42 it was reported as regular but somewhat profuse and in 30 it became profuse. Ninety-two patients reported their condition as improved, and 27 as not improved.

Clark,²⁵ of New Orleans, has had a rather extensive experience with

²⁵ Journal of the American Medical Association, 1919, lxxiii, 952.

radium in the treatment of *various pelvic hemorrhages* and the report that he presented before the American Medical Association last year is worthy of our perusal. For the purpose of presentation, the cases have been divided into three nominal groups. In group 1 are placed those cases in which there is an *excessive bleeding*, with no marked local discomfort, but a decided constitutional impairment resulting from too great a loss of blood. In many of these cases there is no discernible anatomic wrong. Curetting, organotherapy and constitutional remedies fail, the bleeding continues and in severe cases something radical must be done. What this "something radical" must be reduces itself to the removal of some of the organs, or to allowing the future welfare of the young woman to be jeopardized. Surely many of us have encountered such cases, and the action to take presents a serious problem. Clark's experience has not been extensive in this group. In 5 cases there was one in which, by the use of small, graded amounts of radium, the flow was returned to normal. In another case an effort to check the flow by graded doses failed, and the treatment had to be pushed on to complete cessation; but even this was better than an abdominal operation.

Cases of *violent dysmenorrhea* which have resisted all treatment, and in which the general health is markedly impaired, are placed in group 2. The affection is most frequently seen in the neurotic type who are reluctantly yielding to advancing years and are as yet unmarried. It is commonly observed in teachers, or in those lately beginning to work, their mission in life still unsettled. The patient has about ten comfortable days in a month, the rest being spent in bed or struggling to keep up during the premenstrual or postmenstrual storm. In many of these patients there may be found no anatomic wrong, but the distress is there and is gravely altering her life. We have all had these rebellious cases, in which endocrines, stem pessaries, curetting and climatic changes fail, and in which it is imperative that something be done. As a final measure, if the life is to be useful menstruation must be stopped. We know that radium will cause the cessation, and we know further that the treatment is less painful and upsetting than an ablation operation and, still further, that it does not seem to be followed by as intense nerve disturbances. Twelve such cases are reported by Clark, complete relief being obtained in all, chiefly through suppression, but in one instance the treatment relieved the pain and normal menstruation continued.

In group 3 falls the greatest number of cases of this series. For want of a better term "*chronic metritis*" is used. Whether the pathological condition is polypoid, hypertrophic or hyperplastic endometritis, or results from myopathic or vascular changes, most of these conditions are combined in the term "*chronic metritis*." To treat the condition, inflammatory diseases must be eliminated first; next, an exploratory curettage is performed in search of malignancy. Then, by the application of radium, the menstrual life is brought to a close. So far as Clark's experience extends, it seems that the nerve upheaval is less through this method than the surgical. It is well known that most of these uteri have about completed the useful period, and, when complicated by pathological changes following a low grade infection, only

complete removal gives the desired relief. Radium is unquestionably preferable in that it accomplishes the same result with less discomfort and no danger to life. Thirty-five such cases were treated by Clark, with only one partial failure. In this case there persisted an occasional bleeding, especially after coitus, and fearing potential malignancy, the uterus was removed. There is some discomfort associated with radium intrauterine applications, as seen in malaise, nausea and general lassitude, lasting from twenty-four to thirty-six hours, but this is negligible in most cases and its worst form is in no way comparable to the operative course. If radium had no other field of virtue than is evidenced in this group, its use is warranted. Though radium is by no means fully developed, and even if we discount some of the earlier claims for it, there have been produced sufficient positive data to cause it to take rank as a useful agent, and Clark feels that it should be made available to the localities through coöperating professional groups.

Personal Views on Radium Treatment of Myomata. Sufficient time has now elapsed since my associates and I began the treatment of myomas and myopathic hemorrhages of the uterus with radium to arrive at a just estimate of its therapeutic value. Within certain limitations we may, with positive assurance, from our observation of more than 150 cases, assume that, from the standpoint of efficiency, safety and morbidity, this remedy must supplant surgical intervention in these tumors and for the relief of intractable myopathic hemorrhages, as I²⁶ stated before the American Medical Association in June of last year. Beyond these limitations, however, we are also convinced that surgery still has a dominant place in the treatment of properly selected cases. Our experience of the last four years in the use of radium has, therefore, marked out rather well-defined lines of procedure on which we may advance with safety. In any field of endeavor the danger of an innovation is that too much may be expected of it; likewise, too much is often claimed for it. In our first experience we limited the use of radium to women within the menopausal cycle, and we have only gradually, and to a very limited extent, worked outside of the physiologic boundary, for we are convinced that in young women heedless radiation may be quite as unfortunate in its results as were the early efforts of over-enthusiastic or poorly balanced ovariologists. Radium is quite as potent in its power to bring on a permanent menopause, and it is quite as upsetting to the nervous equilibrium of a young woman as the removal of the ovaries. Fifty milligrams of radium applied for twenty-four hours within the uterus of a young woman will in many instances bring on an abrupt and serious menopause; and while in our series of cases one or two patients have received this dosage, it was given in our earlier experience when the potentialities of radium were not fully realized and its dosage was yet within the period of experimental endeavor. We quickly learned that a moderately prolonged intra-uterine application was most hazardous and not to be repeated. As we view this question, three essentials are capital in the use of radium; First, an accurate

²⁶ Journal of the American Medical Association, 1919, lxxiii, 957.

diagnosis in all cases; second, the proper selection of cases; and third, the careful graduation of dosage, beginning when young women are being treated, with a minimum application and increasing the duration of application slightly if the first attempt fails to check the excessive flow.

In our study of results in women within the menopausal years, certain facts stand out in relief. Among the most obvious are these: The tumor must be uncomplicated with coincident inflammatory disease; it must be causing hemorrhage, and it should not be too large. In our cases, when pain, even without coincident evidences of inflammatory disturbance, has been present, it is seldom relieved even though the tumor largely disappears; and in other instances in which there was an old salpingitis, a flare-up of a quiescent process has occurred. In 2 cases a subsequent operation was necessary—in 1, a hysterectomy; and in the other a vaginal puncture of a large pelvic abscess was necessary to relieve the patient. These two instances alone in our large series would not cast great discredit on this procedure, if all the other patients suffering with pain had been relieved of this symptom as the tumor decreased in size and menorrhagia ceased. Such, however, has not been the case, and we have, therefore, established a rigid rule that no patient suffering with pain lateral to the uterus is to be radiated. We choose an operation instead, for we can then ascertain the extent of the pathology and treat it conservatively or radically, according to the indications.

In this connection we desire most emphatically to protest against the use of radium in the treatment of any acute or quiescent inflammatory case, whether associated with a myoma or standing alone. One of my esteemed colleagues, a radiologist, informs me that this point should be emphasized especially, for already an occasional enthusiast asserts that radium may be beneficial in the treatment of pyosalpinx. This degree of optimism is very dangerous and cannot too quickly be discredited, for we have already observed its evil. In keeping this remedy well within its proper bounds, its great value may be established without reflections on it; but through such a policy as that just referred to, its employment will be discredited. The proper selection of the tumor to be treated from the standpoint of size and symptomatology is also clearly necessary, for a therapeutic policy that covers all myomas regardless of structure is, as we view our experience, without justification. We have seldom used radium in a tumor larger than the size of a five month pregnancy, and then only under very exceptional circumstances, such as in the presence of grave cardiac or renal complications or serious constitutional defects which plainly render an operation too dangerous.

The rule which we generally follow is to confine this treatment to cases in which the tumors are the size of a three months pregnancy or smaller. This policy is based on previous years of experience in the surgical treatment of myoma, which has established the great frequency of associated lesions in these large tumors, and we believe, therefore, that we serve a better end in recommending an operation in this class of cases than the application of radium. One not infrequently finds in many cases a degree of anemia not accounted for by the loss of blood and a complexion more like that of cachexia than occurs with an uncomplicated anemia; and

furthermore, there is an asthenia of a toxic type which is not satisfactorily accounted for by a simple blood loss. Seldom is a malignant condition encountered, but not infrequently varying stages of degeneration of the tumors are discovered on macroscopic section marked by a grayish red or slaty discoloration of some of the tumors, indicating a partial gangrene, in others liquefaction necrosis, etc. Through the absorption of these necrotic or degenerating materials, serious inroads on the patient's constitution have occurred and a rapid healthful rebound follows a hysteromyomectomy. Based on these observations, we cannot look with favor on the conversion of these large tumors through radiation into retrogressive tissues, which through absorption may cause toxic symptoms. Under such conditions the patient may serve as the sarcophagus for her decadent tumor. Also, these large tumors are very frequently associated with, or through pressure have produced, other lesions, especially of the inflammatory class. Frequently pressure symptoms have forced the patient to consult the surgeon, and there may be no variation of the menses from the normal. In such cases the tumor may be a pure fibroid, largely of a dense hyaline or calcareous type, certainly not responsive to radiation. For these and still other reasons, therefore, we find no evidence thus far in our experience to convince us that the large tumors should not be removed by approved surgical methods. In no instance has there been so quick a decrease in the size of even the smaller tumors to justify us in believing that the larger tumors which are giving pressure symptoms will diminish sufficiently rapidly in even six months or a year to give satisfactory relief. We stand, therefore, on the general principle against radiation in tumors larger than a three months pregnancy, and in only the exceptional case do we deviate from this rule.

Those who decry the use of radium in all myoma cases ring the changes on the danger of sarcoma. Such objections have no basis in fact, for seldom, indeed, is sarcoma a degenerative or concomitant evil of myoma. If it were as common as is asserted by some of these alarmists, out of every series of 100 partial hysterectomies as are usually performed by American surgeons, a definite percentage of recurrent sarcomas in the cervical stump should be encountered. In more than 1000 hysterectomies performed in the gynecologic department of the University Hospital such a sequel has been observed but once. In a review of 816 myomas in our laboratory by my associate, Dr. Charles C. Norris, he finds only 13 sarcomas, or less than 0.1 per cent., which were not diagnosed at the time of operation, only 26 such cases in this entire series having been encountered. Based both on clinical and on laboratory conclusions, therefore, we deal with fears solely within the domain of fallacious supposition in discussing the dangers of sarcomatous changes in myomas and fibromas. Even were these fears justified, there would still be no strong argument against the use of radium, since these tumors quickly react to this influence. It is not, therefore, the fear of sarcomatous degeneration which makes us slow to radiate large tumors, but it is because of the other objections just enumerated. To define our policy clearly, we would say that we radiate chiefly for one symptom, and that

is hemorrhage. In myopathic changes in the uterus and in the smaller myomas causing excessive flow, a safer or more certain means of relieving this symptom has not been found, for it acts with clocklike regularity and we therefore consider a small myomatous uterus causing menorrhagia in a middle aged woman as no longer within the surgical domain. When radium is not available, the use of the roentgen ray in skilled hands may take its place. In the near future, therefore, we believe that the surgeon who operates in this type of case will have a difficult task ahead of him in justifying his action. Under special headings may be enumerated some of the occasional symptoms accompanying radiation:

Nausea. Frequently within from twenty-four to forty-eight hours after the intrauterine application of radium the patient will experience considerable nausea, not, however, greater than that observed after the administration of one-fourth grain of morphine in the occasional case. As we always perform a dilatation and curettage under nitrous oxide anesthesia, with a preliminary one-fourth grain of morphine administered one hour before the anesthetization, we have often felt that there were about equal chances between the effects of the radium and the morphine in the production of the symptoms: For nausea and vomiting are the exception rather than the rule after radiation. In no case has this symptom been either alarming or persistent.

Pain. This symptom is also a variable factor, and may be attributable to the curettage, which is performed in all of these cases for diagnostic assurance. When this symptom persists or is accompanied by fever, we fear the possibilities of an acute inflammatory attack or the exacerbation of a quiescent lesion. This complication has occurred but seldom. However, it has been noted in possibly twenty or thirty instances in our experience, and we are inclined to adopt in the future the plan of merely dilating the cervix and inserting the radium in those cases of periodic menorrhagias following a cyclic menstrual type without intermenstrual spotting, for in no instance have we discovered a carcinoma of the fundus in any of these cases, notwithstanding a careful routine study of the curettings. In those cases, however, in which there is intermenstrual spotting, or in which there is continuous bleeding, curettage should never be omitted, for this is the court of final diagnostic resort. When this very suggestive symptom has been present, carcinoma of the fundus has occasionally been encountered and an immediate or subsequent hysterectomy has been performed. A simple hysterectomy carried so high a percentage of cures in this class of cases that we never trust to radium, but invariably choose the more radical surgical measures.

Leucorrhea. The rule in all of our cases has been that a yellowish but never profuse leucorrhea will follow radiation for a short time—usually from three to six weeks. Hemorrhage likewise may not cease at once, although this is the rule. We warn our patients against apprehension if the flow does not cease at once, and usually tell them to expect no decided result under six weeks, although the great majority are relieved at once of excessive bleeding, but have a somewhat yellowish, sticky discharge for possibly six weeks, after which it ceases. In

several instances a profuse leucorrhea has actually been cured by radiation.

Menopause. The change of life in these cases varies in its phases, as the constitutional and temperamental characteristics of women vary. In this connection one might employ the lines of the comic opera librettist: "There are never two women alike, and never one woman alike twice." In the more marked grades of anemia we believe the climacteric change is more abrupt and attended with more pronounced symptoms. This may be explained on the theory that the hematogenous system has been working for weeks or months at a great speed in corpuscular generation, since the continuous loss of blood is so great that this excessive deficit must be remedied. A quick check on this great activity must in many instances jar the physiologic equilibrium and thus induce a more acute menopause. So far as we are able to judge, we believe that the menopause is somewhat more trying to the average woman under an abrupt cessation than when she drifts into this change more naturally. In estimating the possible objections to radiation this symptom may possibly be classed in this light, although it in no way differs from the same sequel after hysterectomy in which the ovaries are removed. In general, we find our patients very enthusiastic over their results, and count this possibly trying symptom as of light moment compared with their satisfaction over an escape from an operation.

In four cases we have failed to relieve patients sufficiently to satisfy them or ourselves, and we have subsequently resorted to a hysterectomy. Two patients have been operated on in other clinics. So far as we have observed, no disadvantage has occurred from the preliminary radiation, as all of the patients on whom an operation has been performed have recovered without complications.

Technic of Application. In our entire series of cases we have varied but little in our method of treatment. For women in the menopausal years, one intra-uterine application of 50 mg. of twenty-four hours duration is made. Under gas the cervix is dilated, and a simple curettage for diagnostic purposes is performed, followed by a light packing of the uterine cavity with a 5 per cent. solution of iodine momentarily before the radium is introduced. We enclose the platinum or silver radium container in a black rubber drainage tube securely tied at each end. A 50 mg. tube is inserted into the fundal cavity to the top and left thus for twenty-four hours. When the cavity is $3\frac{1}{4}$ inches or more in depth, we usually use 25 mg. tubes arranged in the rubber tubing tandem fashion, to insure a wider radiation of the uterine wall. After the radium is withdrawn, we usually keep the patient in bed three days, as after ordinary curettage, and at the end of five days she is discharged and permitted to resume her ordinary duties. In women under forty years of age we grade the dosage largely according to their years. As a rule, if the menorrhagia is excessive, we may leave the tube in place twelve hours if the patient is over thirty-five. In still younger women we never apply it more than six hours, choosing rather to make a reapplication several weeks later if the first fails. In this way the menopause will not be induced. There are several instances in our series in which

normal menses have occurred after an interval of weeks or months, even when a twenty-four hour dosage has been applied; but as a rule the menopause is permanent.

In one phenomenal case, that of a woman aged thirty-two, married ten years and sterile, who had suffered from severe menorrhagia which had reduced her hemoglobin below thirty-five per cent., the flow ceased quite abruptly and she passed through a rather severe menopausal period and yet became pregnant and went to term; but through a severe postpartum hemorrhage the poor woman lost her life. In many instances patients have passed through a typical climacterium, and the periods have returned and have then resumed a normal menstrual physiology. This phenomenon has been sufficiently frequent to make us believe that the radio-activity of the usual dosage is expended chiefly within the uterus and not on the ovaries. In considering the amount of radium employed in these cases, we feel that the smaller dosage, such as we have indicated, has given very satisfactory results, and, therefore, it is within the easy range of every well equipped hospital to have available at least 100 mg. of this substance for use in their clinical departments. It should, however, be placed within the jurisdiction of one capable clinician of the staff to advise as to its use. Certainly it is not a remedy for haphazard use, for it requires the training and judgment of a skilled specialist to advise as to when and how it should be applied.

Roentgentherapy in Benign Bleeding. The results that have been obtained in the gynecological department of the University of Zürich during the years from 1914 to 1918 in the treatment of benign uterine hemorrhage by means of the roentgen ray, have been presented by Mandach²⁷ with much enthusiasm. During this period there were 45 cases of climacteric bleeding in which there were no demonstrable pathologic changes in the uterus, or the type that is usually designated chronic metritis and which were very rebellious to internal medication. The amount of the treatment varied to some extent with the age of the patient although, as a whole, the average patient required four series before results were obtained. The series that was used consisted of a five minute radiation in each of three fields on one day, followed by radiation in three different fields on a following day and finally in three other fields on the third day. Between series there was a three weeks interval. The details of the technic that was followed are fully described by Mandach but need not be considered here. Suffice it to state that of the 45 cases of metropathic bleeding, complete amenorrhoea was obtained in 41; in three patients there was amenorrhoea for a few months and then the menstruation returned in very small amounts; while in one patient menstruation continued unchanged in spite of the fact that she had been subjected to sixteen series. Of course in all these patients a preliminary curettage was performed in order to rule out the possibility of a malignant tumor being the cause of the disturbance. The results that were obtained in uterine fibroid cases were also very satisfactory. There were 168 cases that were subjected to the rays, most of which

²⁷ Cor.-Bl. f. Schweiz. Aerzte, 1919, xlix, 1449.

were bleeding freely when the treatment was undertaken. Of these patients there are 108 that have not had any bleeding for over a year, 52 have been free from bleeding for over three months, but it has not yet been a year since the last treatment so that it is too early to tell the ultimate result. Eight patients have had a return of the bleeding, but in four of these a single massive treatment served to cause a permanent amenorrhoea, while in the remainder the treatment was absolutely without effect. These results are certainly very satisfactory when we consider that these patients have been free from their chief symptom, bleeding, without any danger to life during the course of their treatment. Many of these patients had only 20 to 30 per cent. of hemoglobin when they began treatment, but the blood constantly improved and by the time the treatment was completed they were in such a condition as to be able to carry on their usual duties. The question is often asked relative to the manner in which the roentgen ray produces these results, that is, whether the influence of the rays is on the uterus itself or whether it is merely on the ovaries that the amenorrhoea is produced. Mandach states that in his work he has paid special attention to the size of the uterus before and after treatment and he concludes that there is practically no change in the uterus, so far as size is concerned, in the large majority of cases. Therefore, he believes that the maximum and principal effect of the rays is due to the ovarian atrophy which is analogous to a castration.

An opinion diametrically opposed to the views that we have just cited is that of Stein²⁸ who states that he does not deem the roentgen ray treatment of uterine myomas a safe procedure because he believes that it is impossible to determine whether the growth to be dealt with is a benign or malignant tumor. His statistics show that about 50 per cent. of all myoma cases are complicated by pus tubes, hydrosalpinx or hematosalpinx, acute or subacute appendicitis, ectopic pregnancy, etc. In young women who have not reached the menopause, the roentgen ray is almost certain to destroy the function of the ovaries, resulting in a premature menopause. The continued application of the roentgen ray is apt to have a deleterious effect on the intestinal mucosa, Stein believes, and his experience has shown that surgical treatment is the safest (with only 1 to 3.5 per cent. mortality), quickest and most reliable method at our command. This opinion is based on the end-results in more than one hundred operations for uterine myoma.

Operative Results in Myoma Uteri. There were 262 cases operated upon for uterine myomata at the Woman's Hospital in New York City during the year 1918, with a mortality of four patients, or 1.52 per cent. according to a report which has been published by Broun²⁹ and 2 of these patients died of embolus. The remaining deaths were caused in one instance by intestinal obstruction occurring eight days after myomectomy associated with a ventral suspension and removal of tuberculous appendages, while the other death followed within three days after a supravaginal hysterectomy and removal of purulent appendages. The

²⁸ Journal of the American Medical Association, 1919, lxxiii, 95.

²⁹ American Journal of Obstetrics, 1919, lxxix, 333.

two deaths from embolus in the present series of 262 cases taken in connection with seven from a similar cause in the 1500 cases operated on during the eight years previous, in which there were 28 deaths from all causes, gives embolus as the largest causative factor in the fatal terminations. The next highest cause was peritonitis in seven of the fatal cases. In accordance with the usual routine of the day, a follow-up investigation was conducted upon these patients, of whom 117 patients reported for examination. Of this number, 99 were in excellent condition from a surgical standpoint and stated that they felt absolutely well. Five patients complained of menopausal symptoms and their ages ranged from thirty-three to forty-two years. In three, both ovaries and tubes had been removed and in the remaining two, one ovary and tube had been saved.

The few patients complaining of the forced menopause is striking, especially when you consider the 113 patients examined with whom there is no record of any symptom except of a passing character which caused no inconvenience. It may be argued that these patients are hard-working women and not given to noting symptoms which would be distressing to those of the more leisured class, which no doubt is true to a great extent, nevertheless Broun strongly believes that in the presence of tumor growth the function of the ovaries from the standpoint of internal secretions is greatly diminished and in this class of cases their importance in maintaining the nervous equilibrium of the patient is to a great extent overestimated. At any rate this belief is apparently borne out by the study of these cases under consideration where usually one or both adnexa have been removed on account of circulatory changes or infection. Unless there is some special reason, such as possible pregnancy, why an ovary should be conserved after its tube has been removed, Broun thinks it better surgery to remove the ovary at the time the tube is excised and certainly in instances of the removal of the uterus and the remaining adnexa. This opinion founded on clinical experience is borne out by Sampson's study of the tubal and ovarian circulation, since he has shown by his combined tubal and ovarian vascular injection specimens, that much care must be exercised in removal of the tube in order not to disturb the ovarian circulation and at times this disturbance is impossible to avoid on account of the abnormal distribution of the vessels. The results here reported by Broun represent the end-result of surgery applied to a series of consecutive cases by the full operating staff of the hospital and he doubts whether they can be equalled by x-ray or radium even in selected cases, especially when we consider the contra-indicating, unrecognizable degenerative changes present in such tumors and also the associated pathological conditions in the adnexa. Therefore he would use radium or the x-ray in myomata for the purpose only of controlling bleeding and then only when the contents of the pelvis can be clearly mapped out. They are a valuable means under such conditions and by their use can be avoided what would otherwise be a mutilating operation.

Conservative Myoma Operations. The question of the advisability of performing myomectomy rather than hysterectomy in certain cases

of uterine myomata has been discussed on numerous occasions but as yet there is anything but unanimity on this point among gynecologists. The question has recently been investigated in the Frauenklinik at Lund by Essen-Moeller;³⁰ from five different standpoints, namely the immediate operative results, ultimate results, recurrences, subsequent labors and malignant degeneration of the myomata or of the remaining uterus. Concerning the first question, in spite of the fact that for many years myomectomy has always been considered to have a higher mortality than hysterectomy, the author quotes statistics from European as well as American sources to show that such is not the case, while he personally has performed 34 myomectomies without a death. He is, therefore, of the opinion that the conservative myomectomy offers practically as good a primary result as hysterectomy and therefore the latter operation should be confined to those cases which are technically very difficult or in which there is malignant degeneration of the growth.

Taking up the question of the ultimate results of operations he states that 80 per cent. of the cases that have had hysterectomies performed for myomata have been relieved of their symptoms, while only 40 per cent. of the myomectomy cases have been so relieved since many of these latter cases continue to suffer from bleeding and annoying discharges. Therefore from this standpoint hysterectomy would be the preferable operation. Concerning the question of recurrence of myomata after the conservative operation, much will depend on the number of years elapsing between the operation and the examination, because the greater the lapse of time, the larger will be the number of cases in which a recurrence will be found. The mere fact that another myoma has grown, however, is not an indication for a second operation, as many myomata give no symptoms or other inconvenience. Of the 21 patients that this author examined after myomectomy, there was a recurrence in 7 but of these a second operation was necessary in only 4 cases. Nevertheless there can be no question but that myomectomy is distinctly inferior to the radical operation from the standpoint of recurrence.

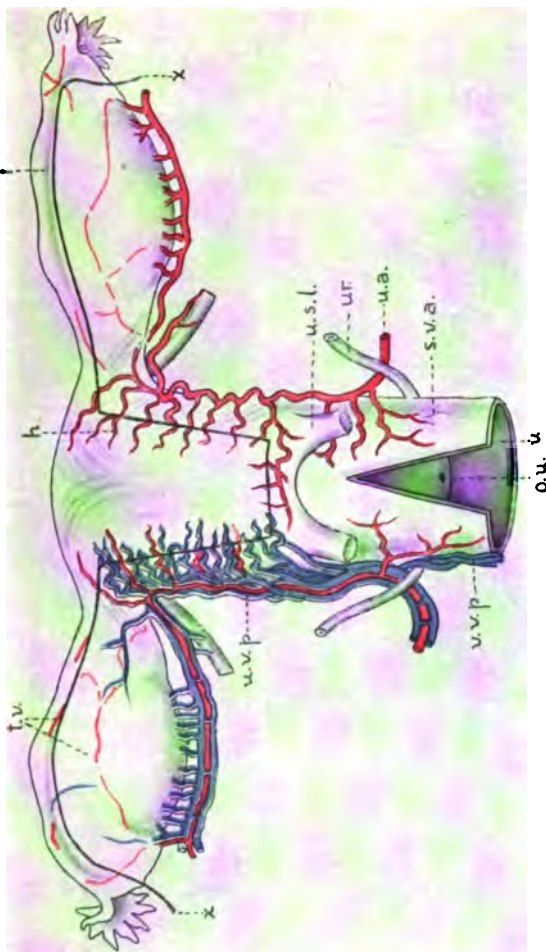
When we consider the possibility of a subsequent pregnancy after operation, there is no comparison between the two operations. Indeed it is this one point that stands as the chief argument in favor of the conservative operation since pregnancy is impossible after hysterectomy. The number of pregnancies that occur after myomectomy is doubtful, the reports of various operators giving statistics varying from 72 per cent. to 3 per cent. A close study of the literature seems to show that the possibility of subsequent pregnancy is most likely when the patient is under forty years of age and also when the tumor that was removed was of a moderate size. Large or multiple growths reduce the possibility of later gestation. In regard to the possibility of subsequent degeneration of the uterus that is left behind, the author has little to say since the pathologists themselves cannot always agree as to whether or not a given picture is malignant. The gynecologist must perform the radical operation in all cases in which there is a suspicion of malignant degenera-

³⁰ *Monatschr. f. Geburtsh. u. Gynäk.*, 1919, 1, 36.

tion, which cases are usually patients over forty years of age in whom myomectomy is not the operation of choice from any standpoint.

Bloodless Hysterectomy. In order to overcome any possibility of secondary hemorrhage following the removal of the fundus uteri, Van Hoosen²¹ has elaborated a technic whereby a bloodless hysterectomy may be performed. After the abdomen has been opened, the fundus of the uterus is grasped with a volsellum forceps and lifted well into the incision or as high as possible. The assistant now maintains traction on the uterus while the operator places the index finger of the left hand under the round ligament and the thumb of the same hand under the ovarian ligament, at the same time retracting the broad ligament from the body of the uterus. With the right hand an eight inch forceps (preferably of the angiotribe pattern) is placed on the body of the uterus from a point opposite the internal os to the tubal attachment and the forceps is closed slowly enough to allow the uterine musculature to slip to the inner side. The forceps is closed lightly without using the racquet. Another forceps is placed in similar manner internal to this and touching it throughout its length. The side opposite is treated in the same way. By this application of forceps the uterine artery and the uteroövarian anastomosis are pushed away from the body of the uterus and the peritoneum covering the uterus is rendered tense. The peritoneum over the uterus on both anterior and posterior surfaces is now incised, beginning one-half inch above the line where the peritoneum is intimately connected with the uterus and extending upward on each side parallel with the forceps and one-half inch internal to it. The peritoneum adjacent to the forceps on both the anterior and posterior surfaces is lifted by undercutting with a sharp knife. Strong traction is now made in turn between the volsellum controlling and holding the body of the uterus and the forceps applied on each side and with a few strokes of the knife the uterine musculature is separated from the parametrium and the uterus is freed down to the internal os. With dissecting scissors the cervical musculature and mucosa is coned out for any distance even to the external os if so desired, and lifted out with the attached body of the uterus. Neither ovarian nor uterine artery having been severed, the suturing may now be begun. The first suture is placed deeply, uniting the anterior and posterior borders of the cervical cone. The internal forceps on the edge of the severed broad ligament are now removed and the remaining forceps are drawn together and held until the cut edges on each side can be united to each other with a lock stitch. The lateral edges are united first from the posterior surface and, after removal of the remaining forceps, from the anterior surface. If a generous border of peritoneum has been left, there will be no surface uncovered by peritoneum except possibly at the tubal location. This can be better covered and at the same time the stump which represents a skeleton uterus can be elevated by passing a suture through each round ligament about one inch from the uterine attachment and by tying them together over the uterine skeleton and fixing them thereto.

²¹ Surgery, Gynecology and Obstetrics, 1919, xxix, 196.



Technic for Bloodless Hysterectomy. (Van Hoosen)

z.z., line of incision; t.r., tubal vessels; h., helicine branches; f., Fallopian tube; u.v.p., uterine venous plexus; t.r.p., vaginal venous plexus; u.s.l., uterosacral ligament; u.r., ureter; u.a., uterine artery; s.v.a., superior vaginal arteries; v.v.p., vagina cut open behind; o.u., os uteri.

If the tubes are to be removed, an eight inch angiotribe or strong forceps is placed on the broad ligament above the ovary and close to the tube and the tube is peeled out of its peritoneal covering and the cut edge of the peritoneum is ligated *en masse*, but not including the ovarian artery.

Factors of Safety in Hysterectomy. In a series of 551 operations for hysterectomy performed by Guthrie²² there were 8 deaths, a mortality of 1.4 per cent. In this series there were 374 supravaginal operations, 63 panhysterectomies and 63 vaginal hysterectomies and the particularly good results that have been attained have been attributed to three points in technic. In the first place, Guthrie believes in the omission of the usual preoperative purging which is so commonly employed in the preparation of patients. Such purging causes a dehydration of the patient and adds materially to the production of postoperative shock and he believes that by merely giving the patient an enema, much better results will be obtained. Another point that he has frequently mentioned in the past is the use of the Trendelenburg position, not only during the operation, but while the patient is being put under the influence of the anesthetic. By the use of this procedure, it has been found that, by the time the operator has opened the peritoneal cavity, the intestines will have gravitated out of the pelvis of their own accord and will not require the usual amount of handling in being "packed off." By thus eliminating a large amount of manipulation of the intestine, another cause of shock as well as postoperative ileus is removed. Finally, morphine is used freely in the postoperative treatment of these cases and by thus keeping the patients in comparative comfort, the psychic as well as the pain factor in the production of shock is eliminated. The observance of such apparently small points in technic are indeed of great importance and mark the difference between the real surgeon and the ordinary operator. There are many operators who are good technicians so far as the actual operating is concerned, but whose results suffer by comparison with the work of others merely because they have failed to observe these finer points in technic.

Ovarian Function after Hysterectomy. The purpose of a contribution to this subject by Richardson²³ is to present an analysis and impartial estimate of the existing evidence for and against retention of ovarian tissue after hysterectomy. Such a study seems both timely and desirable for two reasons: (1) Because our knowledge of ovarian function has been substantially increased during recent years, chiefly through the intensive study of endocrinology, and (2) because there has arisen a sharp division of opinion among those most competent to decide this matter. One group is persistently advocating the routine conservation of healthy ovaries after hysterectomy, while a minority is vigorously condemning the practice as scientifically without justification. From his review of the subject Richardson concludes that the ovary is a glandular organ of complex function, our knowledge of which is at present far from complete although we do know that the uterus is not essential to a

²² Journal of the Indiana S. M. Association, 1919, xii, 71.

²³ Surgery, Gynecology and Obstetrics, 1919, xxviii, 146.

continuance of ovarian function except as regards menstruation and reproduction. The advocates of total ablation have not furnished convincing evidence of the correctness of their contention since the disturbances of ovarian function attributed to hysterectomy are partly those associated with normal menstruation and partly those arising from damage to the ovary through operative trauma or disease. In a word, the weight of evidence furnished by anatomical, experimental, and clinical investigation is overwhelmingly in favor of retention of sound ovaries both before and after the menopause age.

Retroversion of the Uterus. In previous years we have often remarked upon the multiplicity of methods of suspending the retroverted uterus and have also stated that the underlying principles of the newer methods differ slightly if at all from the older operations. During the past year, as usual, several "brand new" suspension operations have been described but we have neither the space nor the desire to record them here. We shall, however, give the principles of a few of these operations, which seem to display some originality and usefulness. Nicholson,³⁴ of Buenos Ayres, desires to bring to the attention of foreign surgeons the operation of "neo-insertion of the round ligaments" as perfected by Caballero which has given very satisfactory results in 1233 operations. It is employed only to correct fixed or irreducible retrodisplacements or in those cases in which some other abdominal condition, such as disease of the adnexa or appendix has made necessary a laparotomy, since in easily reduced retroversions he always employs the Alexander operation. The essential point in technic which the author describes is the making of a musculo-aponeurotic canal through which the round ligament is drawn and then anchored to the rectus sheath. With a pair of Kocher forceps the round ligament is seized about two inches from its uterine insertion, and another pair of Kocher forceps is introduced into the inferior portion of the wound, between the rectus muscle and its aponeurosis as far as the outer border of the rectus sheath and then is plunged through the sheath and peritoneum, entering the peritoneal cavity. This perforation occurs very near the internal orifice of the inguinal canal. The forceps are then opened and the round ligament is seized at the point where it was originally grasped by the first forceps. The forceps is then withdrawn bringing the round ligament with it and the ligament is sutured to the aponeurosis of the rectus about 5 mm. from its border. The same procedure is performed on the opposite side and the abdomen is closed. This operation is very similar to the method of Simpson which is extensively practiced in this country and the reviewer feels that Simpson's method is superior in that it is entirely extraperitoneal. The great argument against this type of operation is the possibility of injury to the deep epigastric artery but the author states that he cannot imagine how an artery the size of the epigastric could be injured by a blunt-pointed instrument. Up to the present time he does not know of a case of retrodisplacement that has recurred after this operation and he has had the opportunity of observing many patients who have been operated

³⁴ Surgery, Gynecology and Obstetrics, 1919, xxix, 194.

upon and who have become pregnant many times, the pregnancy terminating in normal labors. Among his cases there were several that were operated upon during the first few months of pregnancy and with one or two exceptions, the pregnancy has gone on to term and labor has been normal.

Wardlow³⁵ has presented an operation for retroversion, the steps of which are as follows: The abdomen having been opened in the median line, the two round ligaments are caught at such a point that they will be on an easy tension when they are approximated directly across the pelvis. At this point a suture ligature is applied, tied, and left long. This point of approximation is supposed to be the place at which the fundus of the uterus is finally to be suspended when the two ligaments are tied together, as the final step of the operation. The ligaments, when stretched across the pelvis, should not be tense, but should be adjusted



FIG. 68.—The ends of the traction ligatures are each drawn through the corresponding passage by means of the loops and in turn each ligament is drawn into its new position. (Wardlow.)

at a degree of easy tension to allow the recognized mobility of the fundus within the normal physiological limits. The displaced uterus having been raised in the pelvis, the point of the hysterotome is inserted into the tissues as nearly as possible at the point of origin of the round ligament, on the anterior surface of the horn of the uterus. Theoretically, this point of insertion is exactly at the point of emergence of the ligament from the uterine wall, but practically he has found it best to choose a point corresponding to the exact margin of the ligament as it emerges from the uterine horn at its inner and lower aspect. Inserted at this point, the instrument is passed directly backward through the uterine horn, passing under the interstitial portion of the tube. When the instrument has reached a point beyond the tube, its direction is turned downward and inward, traversing the posterior wall of the

³⁵ Surgery, Gynecology and Obstetrics, 1919, xxix, 603.

uterus in a downward and inward direction to a point in the median line and about one inch below the fundus uteri. Here the instrument is made to emerge on the posterior aspect of the uterus. The eye of the hysteroscope is then threaded with a loop of Pagenstecher or silk which is drawn back through the newly made passage by withdrawal of the instrument. This leaves the newly made passage with the traction loop in place throughout its entirety. This same procedure is then followed out on the other side of the uterus, the point of the hysteroscope being made to emerge from the same opening on the posterior surface as it did at the first passage on the opposite side. We are now ready to transplant the ligaments to their new position, and the remainder of the procedure is simple. The ends of the traction ligatures are each drawn through its corresponding passage by means of the loops and in turn each round ligament is drawn into its new position. As the ligaments are drawn through the uterine walls, the uterus is manually raised into its normal position. Traction is continued until the ligated points of the ligament appear in the puncture opening. The traction ligatures are now tied together, cut short, and the knot allowed to drop back into the uterine wall through the small puncture opening.

Young³⁶ described an operation which he calls sacral suspension of the uterus and which we shall not detail here but merely wish to call attention to the fact that the operation is based upon shortening of the uterosacral ligaments, which principle is neglected in far too many cases either as a separate operation or as an adjunct to a round ligament shortening.

Prolapse of the Uterus. The permanent operative correction of a well-marked uterine prolapse has always been one of the bugbears of gynecological surgery and therefore a new method of treatment which utilizes a strip of fascia lata, suggested by Freeman³⁷ may be of interest to those who have to treat such distressing conditions. Having obtained access to the abdominal cavity through a median suprapubic incision of sufficient size, the uterus is brought up into the opening and inspected. If the patient is still within the childbearing period, she must be sterilized, best by ligation of the tubes with silk, dividing them and perhaps folding the severed ends upon themselves. A strip of fascia lata about six inches in length and three-fourths inch in width, is then obtained from the outer side of one of the thighs in the following manner: An incision of sufficient length is made through the skin and subcutaneous fat directly down to but not through the glistening white fascia, and extending along the lateral aspect of the limb midway between the trochanter and the knee. With a gauze-covered finger the adipose tissue is pushed to either side so as to clear the field, and the fascia divided in two parallel lines of the required length. The strip is then loosened and elevated by slipping the handle of a scalpel beneath it and sweeping the instrument from one end to the other. After dividing the attached ends with scissors, the strip is removed and enveloped in moist gauze until required. The slit in the fascia lata from which the

³⁶ Surgery, Gynecology and Obstetrics, 1919, xxix, 267.

³⁷ Ibid., 511.

graft is taken may then be closed with a running suture of chromic gut, although this is not absolutely necessary because no harm will result if this is not done. Returning to the abdomen, the uterus is held firmly while a pair of small, sharp-pointed, curved hemostatic forceps is plunged from one side to the other directly through the substance of the uterus close beneath the peritoneum covering the fundus but not penetrating into the cavity. The forceps should be entered just internal to the attachment of one of the tubes and brought out at a corresponding point upon the opposite side, although, if the organ is large, it may be well to tunnel it somewhat more anteriorly in order to prevent undue pressure upon the bladder when the uterus is suspended from the tendons of the recti muscles. In order to facilitate the insertion of the forceps, it is occasionally desirable to nick the peritoneum with

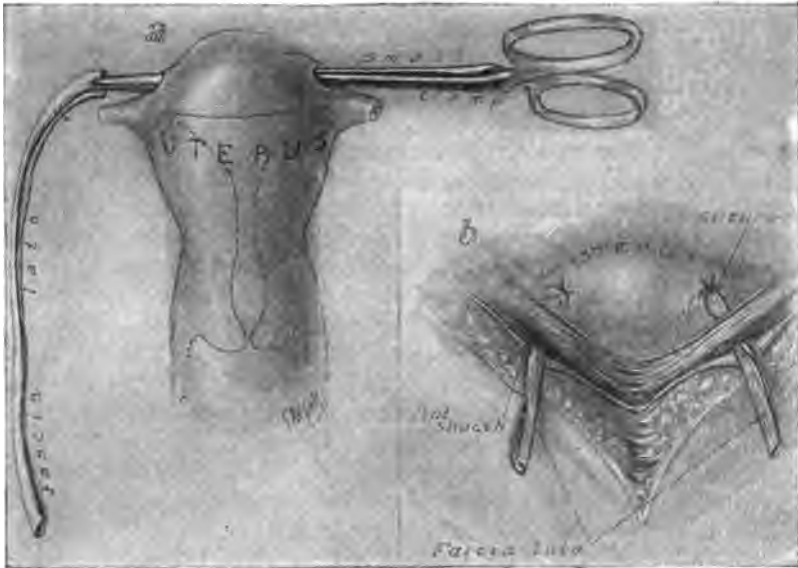


FIG. 69.—Drawing showing Freeman's technic. (Freeman.)

the point of a knife. When the forceps have been passed and are still in position, the fascia is doubled longitudinally upon itself, one end seized in the jaws of the instrument and the strip dragged through so that its center rests in the middle of the tunnel and its loose ends project from either side. Catgut stitches are then inserted so as to close the openings of the tunnel, thus preventing oozing and holding the fascia in place. The next step is to secure the ends of the fascia around the tendinous insertions of the recti muscles in order to bind the fundus of the uterus securely and closely to the anterior abdominal wall. This is accomplished first by stripping back the anterior sheaths of the muscles for a short distance above the pubes, so as to uncover the tendons, and plunging through these and the underlying peritoneum from without inward, a pair of pointed hemostatic forceps with which the ends of the

fascial strips are seized and dragged into place, one on either side of the abdominal incision. After the peritoneum is closed, the ends of the fascial strip which has been retained in the forceps to prevent retraction, are pulled tight enough to hold the uterus firmly against the abdominal wall and are then crossed over the median line best by tying them in a half-knot, and stitched securely to each other in several places by means of chromic gut so that they cannot slip. The wound is then closed in layers. Additional security against slipping may be obtained by catching the ends of the suspending fascia in the bight of a figure-of-eight silkworm gut suture used in closing the abdominal incision. Fascia lata has a number of things in its favor: (1) It is easy to obtain in any desired quantity, (2) it is very strong and will not stretch to an appreciable extent, thus differing from the natural supporting ligaments of the uterus, (3) it does not become absorbed, like catgut, but incorporates itself within the tissues and permanently holds the uterus where it is placed.

Spalding²⁸ has developed a technic for a vaginal operation for the cure of uterine prolapse which begins by exposing the fascia overlying the cystocele by means of a deep transverse incision across the cervix at the bladder junction. If this incision be superficial, the strong fascial plane will remain attached to the bladder. The vaginal wall with the fascia is separated from the bladder rather widely laterally. Before opening the peritoneum the bladder is pushed up and the vaginal portion of the cervix removed as a cone. A stitch is placed on either side of the cervix to ligate the vaginal branches of the uterine vessels, and the posterior half of the cervix is covered by a vaginal flap. The next step consists in opening the peritoneum and lifting the bladder away with a broad retractor. The fundus of the uterus is delivered as in an interposition operation, the round ligaments cut and tied with long catgut ligatures, the broad ligaments are clamped, close to the uterus, as far as the internal os, and the fundus of the uterus removed by amputation. This exposes the sacro-uterine ligaments which are shortened if necessary. The stumps of the broad ligaments are sutured to the cervix and the cut round ligaments carried through the cervical canal and sutured to the inferior surface of the cut cervix. The mucous lining of the cervix is removed previous to this procedure. This pulls the cervix high and gives some support to the lateral walls of the bladder when removing the retractor. The fascia in the anterior vaginal wall is now dissected and overlapped as described by Neel and Rawls, and sutured to the stump of the cervix. This completely closes the bladder hernia. The mucosa is sutured by means of a few interrupted catgut sutures over the fascia and the anterior half of the cervix.

CURE OF PROLAPSE IN THE AGED. The gynecologist is frequently troubled to know how to treat effectively the very old women who suffer from complete prolapsus of the vagina and uterus, especially when the vagina hangs down between the thighs, becoming thickened and often ulcerated. These patients are usually too old to stand a long operation

²⁸ Surgery, Gynecology and Obstetrics, 1919, xxix, 529.

and only an extensive operation will be effective since all the attachments of the uterus and vagina have been destroyed and the atrophic muscles of the perineum are so feeble that they give little chance of a perineal repair. In such cases McArthur³⁹ suggests an operation that resembles a coat sleeve that has been sewn down the center and which therefore cannot be inverted. The operation is performed by stripping an area of mucous membrane from the anterior vaginal walls, about a finger breadth in width from just behind the orifice of the urethra to within a centimeter or two of the junction of the cervix and vagina. A similar area is stripped from the posterior vaginal wall and then he sews together with a continuous catgut suture the anterior and posterior cut edges on the left side, followed by similar suture on the right side, sewing three or four sutures on the left side, then a few sutures on the right side and thus alternating until both suture lines are complete. As the stitches are pulled taut, the cervix recedes into the vaginal orifice until it is lost to touch. The next procedure is to complete the perineorrhaphy by inserting three or four sutures into the already denuded perineum, tying them and completing the closure of the cut edges of the vaginal mucous membrane. When the operation is completed, there is practically a double vagina which prevents prolapse but at the same time allows the discharge of uterine secretions. The operation can be done very quickly and thus is especially indicated in debilitated aged women.

PROLAPSE OF THE UTERUS IN A YOUNG VIRGIN. To most practitioners the subject of uterine prolapse probably calls to mind a middle-aged woman who has had many children or very difficult labors with severe lacerations of the pelvic floor. It may be of interest therefore to refresh our memory on this subject and recall that occasionally uterine prolapse occurs in a virgin usually after the age of thirty. The case reported by Moorhead⁴⁰ is of unusual interest in that it occurred in a virgin who was only eighteen years old. When she presented herself for treatment, she gave the usual history of a swelling at the vulva which had been present for one year, aggravated by exertion and which disappeared when she was recumbent. There was nothing in her history to indicate the cause of this condition aside from the fact that she had been forced to do very hard and laborious work since she was twelve years old. The prolapse was a complete one, the uterus extending two inches outside of the vaginal outlet drawing the anterior vaginal wall with it, although the posterior wall was only slightly involved. In the treatment of this case, Moorhead performed a high amputation of the cervix, shortened the uterosacral ligaments by plication and shortened the round ligaments, by the Gilliam technic. The usual explanation of these cases of prolapse of the uterus in virgins is that there is a congenital weakness of the uterine supporting structures, especially the uterosacral ligaments and the connective-tissue structures in the bases of the broad ligaments, frequently called the cardinal ligaments. Naturally these structures must give way before a prolapse can occur, but whether they are congenitally weak or are weakened by an unusual amount of strain, as

³⁹ Medical Journal, Australia, 1919, i, 149.

⁴⁰ Surgical Clinics, Chicago, April, 1919, p. 407.

Moorhead believes to have been the case with his patient, is a point that will have to remain debatable.

Removal of Intestines During Curettage. From time to time the literature presents the history of a case in which intestines are accidentally removed by an operator during the performance of a uterine curettage. Such cases usually occur when the patient is in the puerperal stage, at which time the uterus is very soft and offers very little resistance to any instrumentation. Aside from the medicolegal standpoint of such an accident, such an occurrence always causes much speculation in regard to the amount of force that must have been expended by the operator in getting into such difficulty. Some experimental work upon the cadaver has been done by Ill⁴¹ in order to have a better understanding of the factors operative under these conditions. His work has demonstrated that any portion of the bowel can be pulled away by traction with a forceps through a rent in the uterus or vagina and that the point of separation will be the junction of the bowels with the mesentery, although in some subjects the separation will be extraperitoneal in large measure. The one important point about this accident that these experiments have demonstrated, from a medico-legal standpoint, is that the mesentery cannot be pulled away from its origin at the spine, no matter how much traction is applied, but the point of separation will always be at the junction of the bowel with the mesentery.

Operation for Hypertrophic Elongation of the Cervix. The operative procedure that has been suggested by Noble⁴² for the correction of that interesting condition known as hypertrophic elongation of the cervix uteri, consists of resection of the middle portion of the cervix supplemented by a shortening of the uterosacral ligaments by way of the vagina. The incision is made in the anterior median line of the vagina after the manner of a vaginal hysterectomy except that in place of encircling the cervix, the ends of the 'Y' terminate at the side of the portio vaginalis. The bladder is liberated from the trigonum to the uterovesical peritoneum and laterally the dissection is extended outward along the base of the broad ligament to the ureter on either side and the peritoneum of Douglas' pouch is stripped free from the cervix up to the internal os. After liberating the neck of the uterus it is detached from the vagina by a V-shaped incision cutting from either side downward and toward the axis of the cervical canal. The incision should be made low enough to place the apex of the V at the vaginal junction. The resection is then completed by a similar incision immediately below the internal os, the effect of which produces a wedge-shaped stump of the uterus which will fit over the remaining cervical stump. At this point, the finger is passed into Douglas' pouch to locate the uterosacral ligament on the patient's left. Should it be completely effaced, its markings may be located by drawing the uterus downward when a fold may be felt extending from the cervico-corporeal junction to the sacrum. With a pair of curved artery forceps thrust through the base of the broad ligament in the space between the uterus and the ureter (below the

⁴¹ American Journal of Obstetrics, 1919, lxxix, 29.

⁴² Ibid., lxxx, 409.

uterine artery) the fold or ligament is drawn well into the vagina and temporarily secured by a retention suture. The ligament on the opposite side is secured in like manner. Following this step the wedge stump of the uterus is secured in the V of the vaginal stump, first introducing a forceps or similar instrument through the vaginal portion and into the cavity of the uterus. Upon such an instrument the two sections are brought together and secured by a mattress suture of kangaroo tendon on either side, the two sections practically dovetailing into one another. To maintain perfect alignment of the canal a suture of catgut fixes the tip of the wedge into the angle of the V. By pulling upon the temporary



FIG. 70.—V-shaped and wedge stump after resection.

retention sutures attached to the uterosacral ligaments, the latter will be drawn into the denuded field and tracing them step by step, using one pair of forceps after another, they may be brought far enough into the vagina to be sutured together in front of the cervix, the latter being forced well back into the hollow of the sacrum to secure normal fixation of the lower pole of the uterus. The excess of the vaginal flap is then trimmed away and the vagina is closed with kangaroo tendon, the lower angles of the incision being left open for drainage. The edema of the vaginal portions which follows, commonly disappears without attention but when the hypertrophy is due to inflammatory changes, wedge-shaped sections of anterior and posterior lips may be removed with good

effect. On account of the relaxation of the vagina and its outlet, posterior colporrhaphy with special attention to constructive reënforcement of the perineum is essential to effective employment of the mechanical principles involved in the technic of the operation.

Tuberculosis of the Uterus. Tuberculosis of the uterine mucosa occurs much more commonly than one would suspect from a perusal of current medical literature, according to Scott.⁴³ It occurs at all periods, but is most common in the decade between the ages of twenty and twenty-nine years. The symptoms are disturbances of menstruation, especially metrorrhagia and dysmenorrhea, feeling of weight in the pelvis, progressive constipation, painful defecation and pain radiating from the hypogastrium to the lumbar region, to the upper thorax and along the perineum. The differential diagnosis must be made between carcinoma, chronic endometritis and syphilis of the uterus. The primary form of the disease is comparatively rare, most cases being secondary to disease elsewhere in the body, but it occurs in four main types, namely, ulcerative, miliary, interstitial and peritoneal, and of these types, the ulcerative is the most frequently found. The prognosis is extremely unfavorable in all except the rare primary cases. The treatment in the secondary cases must be symptomatic and supportive, but in the primary cases, curettage of the uterus will result in a cure, if the disease has not invaded the fallopian tubes. If the tubes are involved, hysterectomy must be the operation of choice. Operative procedures on the uterus, when the seat of secondary tuberculosis, are harmful and are positively contra-indicated.

Secondary Syphilis of the Uterus. Secondary syphilis of the uterus is seldom recognized and in the few cases that have been reported, the lesions have consisted of macules, papules and ulcerations located on the outside of the cervix. In a most interesting case reported by Gellhorn⁴⁴ the signs differed from this general picture in several important particulars. Whereas in all previously known cases the lesion was situated upon the *outside* of the vaginal portion, this is probably the first instance where the specific affection could be demonstrated *within* the cervical canal. This was possible because there was a marked eversion of the cervix which exposed the lower third of the cervical canal. The cervical mucosa showed posteriorly an oblong patch, about $\frac{3}{4}$ cm. in its longest diameter which lay about $\frac{1}{2}$ cm. from the external os. This patch was very slightly raised above the neighboring mucosa and had a finely granular, pinkish surface. At the circumference and extending a little into the patch was a faintly yellowish discoloration. Two other smaller and more nearly round patches lay to the right of the larger lesion, and a fourth patch could be seen upon the mucosa anteriorly. All these patches felt soft to the touch and bled very slightly when rubbed with a cotton-armored applicator. The secretions from these patches showed an abundance of very active spirochetæ of the typical pallida variety. There were no secondary lesions anywhere in the body, and as the state of the primary lesion on the labium minus indicated the recent date of the infection,

⁴³ California State Journal of Medicine, 1919, xvii, 52.

⁴⁴ Surgery, Gynecology and Obstetrics, 1919, xxix, 374.

the intracervical ulceration must be regarded as the first and only secondary manifestation, of syphilis in this patient. Another important point that has been brought forward by this case has to do with the heretofore accepted views that the normal secretions of syphilitic women may cause infection even in the absence of local specific manifestations. In the light of the present observation, however, this conclusion may have to be modified, since the fortunate coincidence of a cervical tear permitted Gellhorn to inspect the *inside* of the cervical canal and to find there the specific lesions with their rich supply of spirochetæ. It is permissible to assume that in all the previously reported cases in which syphilis was transmitted in the absence of any apparent lesion in the vagina or on the cervix, that such lesion existed within the cervical canal but was invisible through the closed external os. Until further evidence to the contrary is obtained, it will be safe to adhere to the old view that discharges contain spirochetæ only in the presence of a local lesion.

The Action of Viburnum Prunifolium. A review of the old clinical literature regarding the drugs efficient in the prevention of threatened abortion would lead the reader to believe that in the preparations of viburnum prunifolium there is available an unfailing remedy, one which quiets the uterus if that organ is stimulated to an abnormal degree of activity at an inopportune moment. The study of the action of certain proprietary remedies, one of the active principles of which was supposed to be derived from viburnum prunifolium, lead Hager and Becht⁴ to test the action of the latter drug also. The results of this investigation indicate that the effect produced on the uterus by alcoholic extracts and decoctions of viburnum bark are of little consequence in modifying the nature of the uterine activity, no uniform pharmacologic effect can be ascribed to the drug, for while a stimulation may seem evident at one time, a similar dose under the same conditions produces an apparent inhibition or no perceptible change whatever. As compared with drugs known to have a specific action on the uterine contractions such as pilocarpin and pituitary extract in the case of a pregnant uterus, the effect is negligible. The change in the contractions of the uterus which sometimes occur on the addition of an extract of the viburnum bark are so slight that the changes may be explained as having been produced reflexly through manipulations of the animal during injection or by the alcohol which holds the drug in solution. It is quite evident that the uterus of animals rendered unconscious by high section responds to the intravenous injection of alcohol and a temporary inhibition or stimulation of the uterus is produced. As far as can be ascertained from the use of laboratory animals, no specific action on the uterus can be ascribed to preparations of the bark of viburnum prunifolium.

THE FALLOPIAN TUBES.

Ectopic Pregnancy. Critical analyses and collective reviews on this most interesting subject almost always invite the attention of any

⁴ Journal of Pharmacology and Experimental Therapy, 1919, xiii, 61.

physician and for this reason the recent review of the gynecological material and records at the Johns Hopkins Hospital by Wynne⁴⁶ is of interest. Of the 22,688 patients admitted to the service during the past twenty-seven years, there were 303 cases of extra-uterine pregnancy, an incidence of 1.3 per cent. The youngest patient was a fifteen-year old white girl, the oldest was a forty-five year old negress. Sixty-one per cent. of the cases occurred in patients between twenty-four and thirty-three years of age, 7 patients were under twenty and 10 were over forty years old. The most common causes for which the patient sought medical attention were pain (84 per cent.), bleeding (31 per cent.), and tumor (7 per cent.). A history of abdominal pain was obtained from 300 patients, the other 3 patients stated positively that there had been no abdominal pain or discomfort and each of these three patients presented an unruptured tubal pregnancy without any evidence of clots or free blood in the peritoneal cavity, therefore, the common appearance of pain as a symptom in this condition is most probably caused by the irritation of blood in the peritoneal cavity. The onset of symptoms may be acute without other prodromal symptoms, although there is usually a history of a missed period or of irregular bleeding. In a second type there is an acute attack following prodromal symptoms, which the patient sometimes ascribes to her pregnancy. A third type of patient gives a history of gradual onset without an acute attack. Recurring attacks of pain occurred in 34 per cent. of the cases, some patients complained of soreness and tenderness rather than of definite pain. In several instances the pain was of several years duration, generally with a recent exacerbation, but in each instance at operation some other condition, usually chronic pelvic inflammatory disease was also present. Thirty-four per cent. of the patients stated definitely that they had missed one or more periods and 10 per cent. said that their lost period had been overdue for from one to five weeks, while 17 per cent. had noticed that the last period was abnormal in some other respect. Nausea and vomiting occurred in a few cases, as in normally pregnant women, and the patients with these symptoms considered themselves pregnant. In the great majority, however, there was a history pointing to intra-peritoneal hemorrhage before nausea or vomiting had occurred. In no case was a positive Hegar's sign recorded. Vaginal cyanosis was not marked in any case and Wynne believes that most cases of tubal pregnancy show no very definite gross changes in the cervix and uterine body, unless the fetus is living. Abdominal tenderness is frequently absent but pelvic tenderness is usually marked, especially when the pelvis is filled with recent clots. The temperature on admission to the hospital was less than 101 degrees in 91 per cent. of the cases, but the majority of patients showed some increase in both pulse-rate and temperature.

The correct diagnosis was made before operation in 46 per cent. of the cases, in 33 per cent. of the cases the condition was not diagnosed, while in the remainder of the cases, ectopic pregnancy was either suspected or diagnosed while the patient was under anesthesia prior to being operated

⁴⁶ Bulletin of the Johns Hopkins Hospital, 1919, xxx, 15.

upon. The classical case of an acute ruptured ectopic pregnancy is usually clear if a satisfactory history can be obtained, but there are a great many cases in which the history points equally well to pelvic inflammatory disease. The latter disease also gives symptoms that not infrequently strongly suggest extra-uterine pregnancy.

Concerning the method of treatment that was applied in this series, the study shows that laparotomy by the abdominal route was preferred in all cases except those in which there was a pelvic hematocele with symptoms and signs indicating infection. In such cases, pelvic puncture and drainage is usually a safer procedure, although a secondary laparotomy may be necessary later for continued pain. The convalescence is usually more satisfactory when a careful peritoneal toilet is performed and all blood clots removed, provided that the condition of the patient warrants the expenditure of time, but irrigation of the peritoneal cavity has been discontinued. Drainage is not employed unless there is some evidence of infection in the pelvis or a general ooze following the release of adhesions. It is interesting to note that tubal rupture occurred in 61 per cent. of the cases, tubal abortion in 19 per cent., while in 20 per cent. of the cases the gestation was unruptured. Of 96 patients in whom there was a possibility of pregnancy after the operation, 36 have since become pregnant one or more times and 61 pregnancies have resulted in 37 full term children. In 16 cases the pregnancy ended in miscarriages and 6 patients had a second extra-uterine pregnancy.

Another analysis of interest has been made by Farrar⁴⁷ of 309 cases of ectopic gestation that were treated in the Woman's Hospital in New York during a recent ten-year period. In 96.6 per cent. of the cases pain alone, or pain with spotting or bleeding, was the chief complaint on entrance. Bleeding alone or bleeding associated with pain was present in 67.4 per cent. of the cases on entrance. In only 18.8 per cent. of the cases was the pain of the character considered peculiar to ectopic gestation and in the remaining cases it was not to be differentiated from that of any severe pelvic lesion. In 48 per cent. of the cases the leukocyte count was below 10,000, and in 49 per cent. it ranged between 10,000 and 20,000. The high leukocyte count in ectopic gestation is not due to infection but to intraperitoneal bleeding and is a valuable aid to diagnosis of the conditions present and in making a differential diagnosis from suppurative conditions where it remains constantly high without any marked drop to normal or nearly normal. In 42 per cent. the hemoglobin was 80 per cent. or above and in 86 per cent. of the cases it was over 50 per cent. The hemoglobin count in ectopic gestation is of doubtful value, as in the acute anemia there is no immediate drop and it is not until forty-eight to seventy-two hours later that it reaches the lowest point, or not until the ectopic is of considerable duration that the count drops to 50 or 60 per cent. In 76 per cent. of the series the temperature was below 100 degrees and in only one case reached 102; but 67 per cent. were 99 or above. It is interesting to note that in every case where the temperature was between 100° and 102° there had been

⁴⁷ American Journal of Obstetrics, 1919, lxxix, 733.

symptoms for some time, and considerable old blood and clots were found at operation. In 87 per cent. of the cases the respirations were below 24, and only 5 per cent. were 40 or more. The majority therefore showed a moderate elevation of temperature, pulse and respiration. In 61 per cent. the pulse was below 100 and in only 8 per cent. did it reach 120 or over, but 57 per cent. were 90 or above.

The conclusions that Farrar reaches as a result of her investigative study are that infection or mechanical alteration due to adhesions of the Fallopian tube predisposes to ectopic gestation. The onset of symptoms or an acute attack occurs equally as often at the time of an expected period, or just after a normal period as it does when a period is overdue, and pain with, or *without*, bleeding is present in every case of ectopic gestation unless unruptured. Tearing, lancinating pain is not as common in ectopic gestation as pain of a cramp-like or bearing-down character. Unusual one-sided pelvic pain, when associated with evidences of peritoneal irritation and fainting, warrant the diagnosis of ectopic gestation. The treatment should be operative in every case as soon as suitable hospital arrangements can be made, deferring examination until in the hospital if the patient is in a serious condition. The end-results justify leaving the other tube in the abdomen at the time of operation, unless positively diseased.

ETIOLOGY OF TUBAL PREGNANCY. Miller⁴⁸ has had a dozen or more cases with a history about as follows: A woman misses her period and not wishing to go through pregnancy, begins after a few days to take drugs to bring on menstruation or to produce an abortion, or perhaps she introduces catheters or other bodies into the uterus. After an interval of a few weeks, she exhibits the signs and symptoms of a tubal pregnancy and operation shows this to be the true condition. The number of such cases which he has had has been so great and the history so typical that he has been forced to the conclusion that there is a causal relation between the taking of oxytoxics, and perhaps the other measures commonly employed in the production of an early abortion and tubal pregnancy. Although he has had no definite or experimental data to confirm such a conclusion, the arguments in its favor can be briefly stated as follows: (1) Impregnation can occur just before a menstrual period. (2) The length of time between the fertilization of an ovum and its implantation in the uterine cavity is generally given as between seven and nine days but it may be longer. (3) Anything which interferes with the passage of the ovum along the Fallopian tube is recognized as a cause of tubal pregnancy, such as tumors in the uterine wall, chronic salpingitis and torsions of the tube. Ergot and similar drugs produce contractions of the uterine muscle and perhaps of the tube, and the introduction of foreign bodies into the uterine cavity likewise produces such contractions. These contractions of the uterus must interfere with the passage of the fertilized ovum down the tube and thus they would tend to the production of a tubal pregnancy. Thus it seems entirely possible to produce a tubal pregnancy in the attempt to bring on an early abortion.

⁴⁸ Surgery, Gynecology and Obstetrics, 1919, xxix, 560.

TREATMENT OF ECTOPIC PREGNANCY AFTER THE FIFTH MONTH. Because of the high mortality connected with advanced extra-uterine pregnancy and the infrequent occurrence of this condition, Beck⁴⁹ concludes that every case should be reported. He has found that the relatively large number of children that survived operation does not justify a disregard of the interests of the child, while the actual operative risk is less during the last month of pregnancy than at any other time. Interference at the thirty-eighth week offers the best opportunity for the survival of the child, but preliminary preparation for the treatment of hemorrhage should precede operation. Before attacking the placenta, a careful exploration should be made to determine the proper procedure to be employed. Removal of the placenta gives the best results and this should be done when it is attached by a pedicle which can be ligated, when there is easy exposure of the ovarian and uterine extremities of its blood supply or when there is easy exposure of the ovarian extremity of its blood supply on the side involved and sufficient accessibility of the uterus to permit of hysterectomy from the opposite side, thus effecting a ligation of the uterine end of the placental supply. Preliminary ligation of the vessels supplying the placental site should precede all attempts at removal, and when preliminary control of these vessels is impossible, the placenta should be left in the abdomen. Closure of the abdomen without drainage is indicated when hemorrhage and infection are absent, even though the placenta is not removed, as the retained placenta will ultimately be absorbed. A slight danger of secondary hemorrhage exists, and infection from the adjacent intestine may occasionally occur before absorption is complete which complications will necessitate a second operation. If suppuration takes place, drainage may be obtained through the vagina. Marsupialization should be limited to those cases in which the removal of the placenta is contra-indicated and the presence of infection requires drainage, or in which hemorrhage necessitates the use of a tampon. The continuous use of drainage invites infection in these cases, as is shown by the results obtained when this procedure was the one of choice.

Technic for Releasing Pelvic Adhesions. There is perhaps nothing more tedious in gynecologic surgery than the proper release of adhesions between the pelvic organs, especially the sigmoid and bladder with the uterus and tubes, as is so commonly seen in pelvic inflammatory disease of gonococcal origin. The separation of the organs is quite easily accomplished in acute cases, but we seldom operate upon the acute cases, so that by the time the surgeon encounters these adhesions, they are firm and dangerous to deal with. Each surgeon must solve these problems for himself as the occasions arise, but it is always helpful to know what other surgeons are in the habit of doing in similar cases, therefore the methods employed by Grad⁵⁰ in these cases will be of interest.

In cases in which two hollow organs are adherent, the cleavage method must be followed as one is working between two walls of important

⁴⁹ Journal of the American Medical Association, 1919, lxxiii, 962.

⁵⁰ American Journal of Obstetrics, 1919, lxxix, 344.

viscera. The organs torn, either the bowel or the bladder, must be repaired by suturing the rent since observation has shown that both the sigmoid and the urinary bladder tolerate injury very well and by repairing these rents the suture line will hold in a very large number of cases. Under all other conditions however, whenever one is dealing with diseased tubes or ovaries adherent to the sigmoid, rectum or loops of small intestine, it is to be borne in mind that separating these adherent bowel structures not along their line of cleavage, but cutting them away at the expense of the parts to which they are adherent, is always preferable according to the experience of Grad. By adopting this technic, the surgeon will have fewer bowel injuries to deal with, which is a very important point of consideration. Not only in pelvic surgery, but in the repair of postoperative hernias the same principle holds good and there need not be any apprehension about leaving pieces of tissue on the bowel wall, as they do no harm.

In cases of tuboövarian abscesses when the sigmoid or rectum is involved, cases with thick massive infiltration of the mesosigmoid, and where the abscess cavity is draining into the bowel, the same technic can be adopted. By utilizing the adherent tissue on the wall of the sigmoid or rectum as the case may be, the rent in the bowel can be closed more readily. It is true that in a very large number of cases, where the sigmoid has been adherent to diseased adnexa, and the outer coat has been torn during liberation, no suturing is required and no harm will result. The cases get along very well as long as the mucous coat of the bowel is not injured and no bad results will follow, nevertheless it is far better not to injure the outer coat. When the lumen of the bowel has been entered, the complication is a serious one and every attempt should be made to repair the mucous surface as accurately as possible.

In repairing the mucous coat of the sigmoid or upper rectum, the inaccessibility of these parts calls for thorough exposure and skilfulness in the placing of sutures, however, with proper repair of the mucous and submucous coats, the healing power of these parts is phenomenal. Having repaired these injuries, the suture line should be allowed to fall against some surface to which it may become adherent, either the posterior surface of the uterus, the cul-de-sac itself or the bowel wall. No drainage material should be placed against the suture line, and certainly no gauze drain should be placed on it. If drainage is called for, it should be placed above the line or to the side of it and it should be remembered that rubber dam is preferable to gauze in these cases.

Tuboövarian Suppuration. It is commonly considered that the chief or only path by which pelvic pus from tuboövarian suppuration seeks to escape is through the posterior vaginal cul-de-sac or pouch of Douglas and indeed this is its most frequent course. However, Green⁵¹ states that not infrequently deep pus, either in or around the tube may be reached surgically by this route before definite fluctuation is obtained and, in his experience, the most useful early indications of the presence of pus are persistent high temperature and leukocyte count in spite of

⁵¹ Boston Medical and Surgical Journal, 1919, cxxxx, 179.

the usually successful palliative measures of ice, elevation and catharsis, increasingly acute tenderness in the mass of exudate behind the uterus, edema of the rectovaginal wall and ballooning of the rectum. When any three of these signs are present, he believes that it is often wiser to go in search of pus and establish drainage through the posterior cul-de-sac without waiting for positive fluctuation, than by such delay to allow the patient to suffer from protracted toxic absorption. If this is not done the inflammatory process may extend upward into an iliac vessel and pyelophlebitis occur, terminating in death. After the drainage of an abscess or tube, the inflammatory process generally subsides sufficiently to permit subsequent safe laparotomy, or may even recover without sufficient residua to demand further surgical intervention. Merely because tuboövarian suppuration usually points to the posterior cul-de-sac should be no reason for overlooking the other avenues by which it may escape. The pelvic abscess, which accumulates in the pouch of Douglas, may equally well point or be evacuated through the rectum as through the vagina. For this reason, rectal or combined examination with the fore and middle fingers should never be omitted. Other sites in which pus may point are the inguinal canal and through the linea alba and Green cites cases of each type and urges palliation first, followed soon by drainage if unrelieved.

Coexistent Disease of the Appendix and Pelvic Organs. All surgeons who have had much experience with pelvic disease in the female, will agree that disease of the appendix is often associated with disease of the female generative organs. This combination is so commonly seen that we seldom stop to consider in which organ the involvement was primary because it makes little difference so far as treatment is concerned in the average case. An analytical study of this subject has been made by Child²² in a large series of cases and he states that, where the primary infection is in the appendix, it is unusual to observe any very extensive pathological changes in the pelvic organs. A few restricting adhesions that, aside from the subjective symptoms they may cause by restricting the mobility of these organs, are of little moment, seldom, if ever, causing permanent tissue change to be observed. An exception to this may, however, be taken when the appendix is in the pelvis and suppurative, for in such cases it is not unusual for the pus to gain access to the tube through the fimbriated opening, or to the ovary through the site of a recently ruptured Graafian follicle, and cause extensive adnexal destruction. When the primary infection is in the adnexa, the secondary involvement of the appendix becomes a much more serious matter, for here extensive pathological changes often take place that later break out into an acute attack menacing the life of the patient if the appendix is allowed to remain. The interference with nutrition alone to a slightly involved appendix resultant on the removal of the right appendages may be sufficient to cause a rapid degeneration in that organ.

In the 746 cases of this series, the appendix was removed 339 times.

²² American Journal of Obstetrics, 1919, lxxx, 31.

It was pathological 244 times, giving a percentage of 32.57 for the whole series. This percentage was much higher in the inflammatory conditions of the adnexa, where it averaged 46.70 per cent. In the cases where the inflammatory affection of the adnexa was limited to the right side, the percentage of involvement of the appendix was 66.66, while in those cases where it was on the left side only, the appendix involvement dropped to 18.42 per cent. The appendix was found in the pelvis adherent to diseased right adnexa in 75 cases. Of these, 25 showed acute inflammatory changes, while 37 were either subacute or chronic. Gas distention of the appendix was encountered 3 times. Only once was the appendix or any part of it found to the left of the mid-abdominal line, and in this case a very long appendix measuring over 5 inches in length, was drawn well over into the left abdominal quadrant where it was adherent to the sigmoid. As a result of this study Child concludes that disease of the pelvic organs in the female is an important exciting cause of appendicitis, and to a lesser extent the appendix may be a cause of right adnexal disease, but in by far the greater number of cases of coëxistent pelvic disease and appendicitis, the primary source of infection is in the pelvis. Involvement of the appendix is nearly four times more frequent in right adnexal disease than in left and, as a possibility of an involved appendix should always be borne in mind when operating upon diseased adnexa, so also should the possibility of diseased adnexa be borne in mind when operating on the appendix.

Operation for the Production of Sterility. It is occasionally important to sterilize a woman without removal of any of the organs and it has been found by experience that simple tying, section, or even exsection are inadequate as the lumen of the tube readily becomes reëstablished. The procedure recommended by Cupler⁵³ has been successfully used by him during the past ten years and he has had occasion to observe the results of the operation several years after it was performed but has never seen any attempt toward restoration of the lumen of the tube, so that he believes that it will secure sterility in 100 per cent. of the cases. In brief, the operation consists of placing a catgut ligature around a small area in the broad ligament including the bloodvessels supplying a limited part of the tube. The tube is then divided and a peritoneal cuff on the proximal end is turned back, the denuded muscle and mucosa of the tube are crushed in the bite of an angiotribe and a catgut ligature is applied in the crease, and the cuff rolled over the stump and ligated. The distal end of the tube is ligated and both ends approximated and the rent in the broad ligament closed. The opposite tube is treated in the same manner and the abdomen is closed. In those cases where it is advisable to produce a *temporary* sterilization in the female, Turenne,⁵⁴ of Uruguay, has suggested the following operation. After the integrity of the adnexa is established, the broad ligament is held with two hooked forceps in a way to present amply its anterior surface. Ten or 15 mm. from the lower tubal border and near the ostium he makes a 15 or 20 mm. incision in the anterior layer of the broad ligament, separates the edges

⁵³ Surgery, Gynecology and Obstetrics, 1919, xxviii, 317.

⁵⁴ Ibid., xxix, 577.

of the incision and hollows out in the cellular space which separates the two layers of the ligament a little pocket sufficient to contain the tubal ostium. The ostium is folded in this pocket and sutured and for greater security it is fixed to the ligament at a separate point near the tube. In this manner the organ retains sufficient mobility, it is not violently kinked and prolonged observation does not show any circulatory disturbance of any sort. With this technic, one can be certain of being able later to do with ease a salpingostomy and to adjust the opening to the ovary.

Torsion of Hydatid of Morgagni. The occurrence of a small cyst with a string-like pedicle, having its attachment to the lower margin of the fimbriated extremity of the tube is frequently observed. These are generally considered as derived from the Wolffian body or its duct and their presence has little pathologic or other significance. However, a case that has been reported by Waters⁵⁵ is of passing interest in showing that a cyst of this character, by virtue of its long attenuated pedicle, may be subjected to torsion and give rise to acute abdominal disturbance of unusual severity. In this case the history and physical examination both pointed to an acute abdominal disease of a surgical nature but nothing was found in the abdomen except gangrene of this small cyst as a result of torsion of its pedicle.

THE OVARIES.

Comparative Physiology of the Corpus Luteum. In recent years some very interesting facts have been observed by veterinarians on the influence of the corpus luteum on sterility and abortion in the cow and it has occurred to Ochsner⁵⁶ that these data might be of great value in solving some of the similar problems in the human female. It has been observed, for instance, that if a false corpus luteum remains unabsorbed in either ovary of a cow she does not come in heat, a condition which corresponds to amenorrhea in woman, and so long as the cow does not come in heat she, of course, remains sterile. On the other hand, as soon as the false corpus luteum is absorbed normally or is expressed manually by the operating hand of the veterinarian, the phenomenon known as heat develops within twenty-four hours. This observation has been made so many times by a sufficient number of highly trained, experienced veterinarians that in the mind of the veterinary fraternity it is no longer a debatable question. Ochsner has had a number of patients with premature menopause, who gave the history of having suddenly stopped menstruating because of a severe chilling during a menstrual period and who have never menstruated since, and another considerable number of patients who, following a severe chilling or illness during a menstrual period, menstruated only at intervals varying from several months to several years who have had the distressing symptoms of artificial menopause, whom he today would laparotomize, carefully examine the

⁵⁵ Journal of the American Medical Association, 1919, lxxii, 1072.

⁵⁶ Illinois Medical Journal, 1919, xxxv, 225.

ovaries and if an unabsorbed corpus luteum were found, excise the same with the hope of relieving their symptoms, reestablishing menstruation and curing their sterility.

Veterinary surgeons have also made another very important discovery. Sometimes in expressing what they consider a false corpus luteum, they have actually expressed or ruptured a true corpus luteum; in which instance one of two things has invariably happened, either the cow has bled to death in a very short time or she has aborted within from twenty-four to thirty-six hours. This observation on the cow throws very interesting light on two somewhat obscure problems in gynecological surgery, namely, the problem of abortion and the frequent finding of blood in the peritoneal cavity, which so frequently has been ascribed to ruptured extra-uterine pregnancy, but in which, on careful examination, no placental tissue has been found microscopically. The experience of veterinary surgeons, as well as Ochsner's experience in operating on pregnant women, leads him to believe that abortions following abdominal traumas are caused by injury to the true corpus luteum and not to traumatism of the uterus itself and that in operating upon pregnant women, the important precaution is to avoid traumatism to the ovary containing the true corpus luteum, if one wishes to avoid interruption of pregnancy. He has operated on a goodly number of pregnant women in almost every stage of pregnancy for a variety of abdominal conditions, such as intestinal obstruction, hernia, appendicitis, gall-stones and even fibroids of the uterus without ever having caused an abortion and he believes that this has been possible because he has always been very gentle with the ovaries at the time of such operations, not because he has known the fact that injury of the true corpus luteum would produce abortion, but because he has made it an invariable rule to treat all intraabdominal organs with the greatest care and consideration.

Carcinoma of Ovarian Teratoma. In view of the evident irritating character of the contained cyst fluid, together with the chronic irritation caused by the hair, producing as it does granulation tissue with giant-cell formation, it is remarkable that more cases of carcinomatous degeneration of the epithelial lining of teratomatous cysts, commonly called "dermoid cysts" of the ovary, have not been observed. A possibility exists that too often these tumors are regarded as innocent and no gross or microscopic examination of the tumor is made as a matter of routine. In view of the skepticism usually expressed in commenting on carcinoma of the ovary arising from the epithelial lining of a cystic teratoma, the case recently reported by Spalding⁵⁷ is of more than passing interest. The tumor was noted some days after operation following the laboratory routine which has to do with more pathology than the staff can promptly handle. It has taught the lesson however, to cut all tumors grossly in the operating room and to have frozen sections made in suspicious cases before the abdomen is closed. In this case the tumor that was removed had all the appearances of an ordinary dermoid cyst, containing gelatinous fluid and red hair, but in addition there was a

⁵⁷ American Journal of Obstetrics, 1919, lxxx, 401.

small nodule, yellow in color, which was resting on the cyst lining and which was surrounded by a narrow margin of ovarian tissue.

Microscopic examination of this nodule showed a thin stratum of pavement epithelium with a distinct basement cell layer. This epithelial layer varied in thickness and at one point gives the appearance of malignant change. The epithelial cells are increased in number at this point forming a small epithelial pearl which seems to be breaking through the basement cell layer to invade the deeper tissues. Immediately beneath the epithelium is a layer of connective-tissue and muscle cells which contain many sebaceous glands and several hair follicles. Several of these glands are invaded with epithelial cell masses resembling basal cell carcinoma. Intermingled with the deeper layers of the connective tissue and extending to the fibrous capsule of the teratoma, but not penetrating it, is a carcinomatous mass forming in part solid masses of small round epithelial cells surrounded by a scanty amount of connective-tissue and in part small collections of epithelial cells having an alveolar arrangement. From this pathological picture it is very difficult to decide whether the process is an adenocarcinoma or a basement cell carcinoma and whether the malignant tumor is primarily in the ovary or comes from a malignant degeneration of the epithelial lining of the teratoma. In the year and a half that has elapsed since operation there has been no evidence of a recurrence, a fact uniquely at variance with the heretofore reported cases. This suggests the possibility that with early carcinoma the prognosis may be good because of the thick protecting capsule of the teratoma.

Primary Chorionepithelioma of the Ovary. Primary chorionepithelioma of the ovary is rare, indeed some authorities consider the ovary to be by far the most unusual site for the extra-uterine development of this form of malignant tumor, so that a case of this kind which has been reported by Kynoch⁵⁸ may be of passing interest. The history of the case is that of a nullipara, aged twenty-four, who complained chiefly of severe pain in the left iliac region, with irregular vaginal hemorrhagic discharge of six weeks' duration. The menstrual history was negative until fourteen weeks before the patient was admitted to the hospital when there was for eight weeks amenorrhea, followed by the hemorrhagic discharge just mentioned. On examination, the uterus was found slightly enlarged, and in the left fornix there was felt a round, tender swelling about the size of a hen's egg, corresponding in position to the left ovary. Laparotomy was performed and the left ovary was found enlarged, nodular on the surface and of a dark purple appearance. It was of such soft consistence that it ruptured and bled freely during the manipulation necessary for its removal, bringing to mind the possibility of an ovarian pregnancy. The convalescence was uneventful, the patient leaving the hospital three weeks after operation, but one month later she was re-admitted complaining of a swelling at the seat of the abdominal incision, which was about the size of a billiard ball, firm and tender and which was regarded as a hematoma. It increased rapidly in size how-

⁵⁸ Edinburgh Medical Journal, 1919, xxii, 226.

ever, and an incision was made into it and it was found to consist of a liver-like substance. Examination per rectum now revealed a soft doughy tumor bulging into the lumen of the bowel. The patient became progressively weaker and died three weeks later. At autopsy, the pelvis was found filled with recurrent chorionepithelioma and metastases were found in the lungs and liver.

The Menopause. Although this article was written by Norris⁵⁹ ten years ago and published at that time, at the request of numerous subscribers, the publishers have again printed it and on account of the extreme importance of this subject a brief abstract is deemed worthy of consideration. Norris has made a very careful study and analysis of 200 apparently normal cases in order to determine the exact character of a normal menopause concerning which there has always been so much mystery and confusion. His conclusions are that menstruation being dependent upon an ovarian secretion, it is fair to assume that the menopause is due to a change in the ovary, which theory is borne out by clinical facts, histological studies and animal experimentation. The generally accepted statement that the menopause is established at forty-two to forty-five is incorrect, but forty-six to forty-nine is nearer the actual age in the eastern United States. Among normal women the age at which the menopause appears varies within wide limits, being influenced by many factors: Child-bearing, marital relations, good nutrition and hygiene, city life and education prolong menstrual functions, while converse conditions tend to an earlier menopause. Climate and race undoubtedly play a definite part in the age at which the menopause occurs but are probably of a secondary importance in the United States. Hereditary influence is in many cases a potent factor since in some families the menopause occurs early, in others late. In the majority of cases, the chief feature of the menopause is not the cessation or diminution of bleeding, but the neuroses which frequently antedate any change in the menstruation and may continue for six to eighteen months after the final cessation of bleeding. The actual bleeding is, however, the barometer of health, and normally the menopause is established without an increased loss of blood. When menorrhagia occurs, an examination is indicated, while metrorrhagia should always be viewed with suspicion. In about 90 per cent. of absolutely healthy women the menopause occurs normally, but among average women fully 30 per cent. present symptoms which call for a careful physical and gynecological examination. All women at the menopause should be under the observation of a physician since care of the cases at this time will result in the menopause being established with less discomfort to the patient and many malignant neoplasms will be diagnosed earlier than would otherwise have been the case.

VERTIGO OF THE MENOPAUSE. Although vertigo is seldom the only prominent symptom of the menopause, since it is almost always accompanied by such disturbances as hot and cold flashes, cold perspiration, palpitation, blurred vision, flickering before the eyes, headache, nausea,

⁵⁹ American Journal of Obstetrics, 1919, lxxix, 767.

etc., nevertheless it is one of the most interesting phenomena that occur at this important time of life and has been the subject of investigation by Sanes.⁶⁰ Like most other investigators who have studied this condition, he attributes the vertigo to a lack of the internal secretion of the ovary and most of his contribution has to deal with the question of treatment. Before any plan of treatment is decided upon, one must make sure that the case is one of climacteric vertigo. Such pathological conditions as lesions of the internal ear or of any other part of the balance mechanism, such diseases as cardiovascular, renal and ocular, especially muscular unbalance of eyes, must be excluded.

If the case can be definitely diagnosticated as that of climacteric vertigo, the *treatment* must always be that of the menopause in general. As the metabolism is almost always below par in the menopause, the nutrition and elimination of the patient must be looked after, and, as the insufficiency or absence of the ovarian internal secretion is the underlying cause of the symptoms, ovarian organotherapy is logically indicated. Sanes reminds us, however, that we do not know the active principle of the internal ovarian secretions, in fact, we do not even know definitely which part or parts of the ovarian substance (Graafian follicle, corpus luteum or the interstitial cells) is responsible for the internal secretion. It seems plausible therefore, that if the administration of glandular tissue successfully replaces a deficiency in internal secretion of the gland, the whole ovarian substance, in the present state of organotherapy, should meet best the needs of a menopause patient. For this reason, Sanes prefers using the whole ovarian substance in the treatment of climacteric disturbances in general and vertigo in particular. There is one difficulty that is met by those who prescribe glandular extracts and that is the lack of standardization of the preparations. One must specify the name of the manufacturer or the proprietary name of the ovarian preparation to get the dosage desired, since one manufacturer will base the dosage of an ovarian preparation on the quantity of the *fresh* ovarian substance in it, while other manufacturers will base their product on the amount of *desiccated* substance contained. Sanes uses a preparation of ovarian extract, each grain of which represents a grain of the fresh ovarian substance, the dosage being 5 grains two to four times a day. Larger doses were only occasionally found to be of any more benefit than the small doses routinely used. In this study, the records showed that about 37 per cent. of the cases were improved, while in 25 per cent. there was complete control of the vertigo by using the ovarian extract. In an occasional case, the addition of a small dose of thyroid extract to the ovarian extract seemed to have been a benefit.

THE VAGINA AND VULVA.

Permanent Rectal Cloaca. A case in which for over thirty-five years a woman defecated and urinated, and for eleven years menstruated, by the rectum is worthy of a final record as an evidence of the possibilities

⁶⁰ American Journal of Obstetrics, 1919, lxi, 7.

of surgery and especially of the conclusive evidence it affords that the rectum can be utilized as a common cloaca for the urine and the menstrual flow as well as for the feces for an indefinite period. The condition necessitating this novel use of the rectum was a case of extensive and incurable vesicovaginal and rectovaginal fistulæ caused by sloughing as a complication of typhoid fever. The patient was a woman, thirty-five years old, who first came under the observation of Keen⁶¹ in 1873. In 1872, she nursed her husband in a fatal attack of typhoid fever and then fell ill of the same disease. About the fourth week the labia minora sloughed away and both urine and feces escaped through the vagina. Six unsuccessful attempts were made to close the fistulæ by plastic operations, and, in 1875, being convinced of the impossibility of success, Keen proposed to her the absolute closure of the vagina leaving the fistulæ wide open, which she at once accepted. The operation was a success except at the anterior end of the cicatrix, which held everywhere else and failed at the internal end of what was left of the urethra, the vesical end of which had sloughed away. Several minor but always unsuccessful operations were done here until finally he excised this small end of the urethra. This was her twelfth operation and was entirely successful. After the operation fistulæ in the cicatrix broke out in 1877, 1896, and 1904, usually causing only a little leakage and only when in the erect posture. Once the fistula healed spontaneously, once after a minor operation and the third time after several small pockets were emptied of urinary concretions. At the date of her death, in 1911, at the age of seventy-three, she had remained dry and well with the exceptions noted for over thirty-five years after the closure of the vaginal outlet. During all this long period she urinated only once or twice at night and five or six times during the day. No ascending renal, vesical or uterine infection occurred at any time nor did the mucous membrane of the rectum at any time resent the constant presence of the urine or the periodical presence of the menstrual blood.

Treatment of Cystocele. That cystocele and prolapse are practically always associated with an impaired pelvic floor function due to relaxation or injury resulting from childbirth is, of course, recognized by all. Ward⁶² summarizes these injuries to the anatomical structures which play a part in the etiology of cystocele as follows: (1) Detachment of the anterior vagina and the bladder from its normal relation to the anterior cervical wall with a loss of the normal invagination of the cervix and a resulting *weak spot* at this site. (2) Attenuation and separation of the fibers of the uteropubic fascia, the result of stretching. (3) Displacement downward of the bladder. (4) Anteroposterior increase in the length of vaginal wall and bladder base. (5) Transverse increase in width of vaginal wall and bladder base. (6) Thinning of the vaginal wall in the mid-line. Two mechanical principles are involved in the correction of these cases, namely, suspension and support. Interposition is, of course, a form of support below the bladder and is only applicable to the non-childbearing cases. In these women we may

⁶¹ *Annals of Surgery*, 1919, lxi, 606.

⁶² *American Journal of Obstetrics*, 1919, lxxix, 593.

employ any principles in the repair which will produce the most positive fixation of the organs irrespective of their normal relations. The non-childbearing cases which are not accompanied with prolapse beyond the second degree, are readily and satisfactorily corrected by the Watkins' method of interposition provided the uterus is in a normal condition. Unfortunately, however, in a large number of these cases the uterus is not in a condition which makes it safe or wise to retain it. If the uterus is diseased, or unsuitable for the purpose on account of its size, Ward believes that the operation is not advisable unless part of the uterus is removed.

In the child-bearing women, no matter what operation is performed, all injuries must be corrected by the following essentials:

1. Mobilization and elevation of the prolapsed bladder in the pelvis, disposing of the enlarged bladder base.

2. Re-attachment of the vaginal wall and the "bladder pillars" to the anterior cervical wall, high up above the pivot point, thus angulating the vagina and using it as a tractor on the bladder base, at the same time disposing of its excess length and restoring the invagination of the cervix and anteverting the uterus.

3. Approximation of the attenuated fibers of the uteropubic fascia at the bladder base to give support in the center.

4. Resection of the excess thinned and stretched vaginal wall in the median line.

5. In cases complicated with prolapsus uteri, reefing of the elongated base of the broad ligament by approximation in front of the cervix, thus elevating the uterus and throwing back the cervix so that the uterus will become anteverted, in order that it may deflect intra-abdominal pressure.

In all cases complicated with prolapsus uteri sufficient to have an associated retroversion, Ward believes that shortening of the uterosacral and round ligaments is necessary in addition.

PERSONAL VIEWS ON CYSTOCELE. About a year ago in my hospital service we reviewed 100 cases of prolapsus uteri, practically all of which had associated cystoceles, and we were able to trace 86 cases. Out of this number there were only 6 failures. These results were all carefully reviewed as the result of our follow-up system of letters and personal examinations of the patients by some member of our staff or by their family physicians. Among these few failures, the chief symptoms were more or less irritability of the bladder, in some cases incontinence, which indicates defects in the cystocele part of the operation. The more we see of these cases, the more we realize the correctness of the adage "no hernia without break in fascia."

Therefore, if this uteropubic fascia is either broken or greatly stretched, a hernia of the bladder will inevitably follow. Further, a point which Goffe has brought up and which has again been noted by Ward, is the potency of the fascial connection between the bladder and the uterus in preventing a cystocele. In many labor cases, this attachment between the two organs is broken, and, even if there is no laceration of the pelvic floor, more or less prolapsus of the bladder will

follow. I am therefore very strongly in accord with Ward in his view that in the majority of these cases the cystocele begins its descent at the cervicovesical junction and that if this is not corrected, there may be a recurrence.

We have worked out on the same general principles, and without any thought of claiming originality, an operation which has for its purpose the restoration of this fascial envelope and the connection between the bladder and the cervix. We carry our incision from the urethra back to the cervix, thus extending the incision further to the front than does Ward. I believe we accomplish a little more by this means, especially in overcoming a tendency to incontinence, which so many of these patients complain of. After the incision is made, the fascial support is dissected free and the bladder is well pushed up on the face of the uterus. A continuous stitch of the Cushing type is then carried from the external urethral orifice, both infolding and pushing up the bladder until the cervix is reached, where it is closely applied by reinforced sutures to the anterior cervical wall higher up than it is even under normal conditions. This reduces the hernia at this point, exactly as the internal ring of an inguinal hernia is closed.

The result of our study of 100 cases, I am certain, very well justifies the method. In some cases the tissues are so seriously disturbed or even destroyed by a very difficult labor that there may be and probably will be a minimum percentage of recurrences in any series of cases. We started our review under the supposition that because of this deficiency of tissue we would find more recurrences among older women than in the young. In this we were in error as our six defective results occurred apparently without regard to age. The combined tendency of gynecologists and obstetricians in general is toward meeting the indication along the same line and the operations that have been suggested by several very competent operators show a similar endeavor. We have been particularly gratified in our series of cases at the relief of incontinence following this plan of procedure. Indeed, we now approach any case of incontinence with an optimistic degree of assurance that we can cure it through incising the anterior vaginal wall and exposing the sub-vesical fascia and by its careful infolding a perfect result is accomplished. I have, therefore, discarded all other plans of curing incontinence in favor of this one as it has stood the test of time.

Modified Watkins Operation in Child-bearing Women. There is no more difficult problem in gynecology than the cure of large cystoceles in young women, in whom further child-bearing is to be expected. The moderate cystocele is not much of a problem, particularly that which follows a spontaneous labor. Here, if it is large enough to cause symptoms, almost any of the denudations of the anterior wall, which go wide enough to catch the retracted fascia will give a symptomatic cure. But the very large cystocele with usually considerable prolapse of the uterus, is a very different thing. The deformity is most often the result of a difficult forceps delivery, particularly after axis traction forceps delivery, and all attachments of the anterior and lateral vaginal walls

are stripped loose by the drag on the head. In these cases, J. C. Hirst⁶³ believes that the ordinary operations for cystocele are sure to fail. Even if a temporary good operative result is obtained, recurrence after subsequent delivery is certain to occur, usually in an aggravated form. The only operation to be depended on in such cases is the one known as the Watkins-Wertheim of interposition. In the patient in whom further child-bearing is not to be expected, whether because of her age or because she is sterilized at the time of operation by section of the cornual ends of the tubes, the operation in its original form of extreme anteversion of the uterus gives splendid operative and symptomatic results. But its original form is not adapted for use in the young woman in whom further child-bearing is desirable and to be expected. Hirst has used for some years a variation of the technic of the original interposition operation, designed to permit future child-bearing, and with which he has had reason to be satisfied, both from the standpoint of the immediate operative result, freedom from difficulty in future labors and particularly lack of recurrence after labor. In performing the operation, the stitches that hold the uterus to the vaginal fascia do not pass through the fundus of the uterus but are inserted at the junction of the middle and upper third of the anterior uterine wall so that the uterus is simply held forward and is not extremely anteverted or anteverted as in the original operation, and it is left as an intraperitoneal organ. He has performed this operation on 89 patients and has been able to trace 49 of them. Of this number, 7 have become pregnant, of whom 2 miscarried, due probably to overexertion of which there was a definite history in each case. Five went through labor at term, one of them twice. Four of the 5, including the one with two deliveries, show a very normal looking anterior vaginal wall: The surgical result is good, and they are symptomatically well. The fifth case has a measure of recurrence. The anterior wall sags considerably, but nothing like the extent of the previous cystocele, but the patient is symptomatically well and insists she requires no treatment.

Vaginal Hernia. Judging from the very few cases reported, vaginal hernia must be of extremely rare occurrence and for this reason Sweetser⁶⁴ has reported a case that has come under his observation. Clinically, the case resembled the ordinary rectocele, but, under anesthesia, examination of the rectum revealed the fact that it was not prolapsed and took no part in the formation of the swelling and upon careful dissection the tumor wall was found to be peritoneum, which was very thin but easily separated from the anterior rectal wall. The sac was opened and some clear yellow fluid drained away, but no coils of bowel appeared which was due to the fact that the omentum was adherent to the upper wall of the hernial cavity as a result of an old inflammatory disease. The abdomen was opened and the hernial opening in the pelvic floor was closed by sutures which included the sacro-uterine ligaments. The sac was excised and the vaginal incision closed. As regards diagnosis, these herniæ have been mistaken for

⁶³ Pennsylvania Medical Journal, 1919, xxii, 546.

⁶⁴ Annals of Surgery, 1919, lxix, 609.

prolapse, for vaginal cysts and for abscess, and several have been operated upon under such mistaken diagnosis, the gut being incised or even excised with fatal results. It is therefore well to bear in mind that such herniæ do occasionally occur.

Laceration of the Vagina from Coitus. Coitus as the cause of a laceration of the vagina except in cases of rape or marked disproportion between the penis and vagina is quite rare and consequently it is interesting to note that one case of this kind has been reported by Stokes⁶⁵ and two other cases have been reported by D'Arcy.⁶⁶ All three of these patients have had children although in one of the cases, the ovaries had been removed several years ago and the vagina had undergone the characteristic atrophy subsequently. In a second case the vagina was somewhat shorter than normal due to an old perineal tear that had not been repaired, but in the third case the pelvic organs were absolutely normal and no explanation could be given for this unusual accident.



FIG. 71.—Syphilitic induration of the vulva.

Syphilitic Induration of the Vulva. To a large group of cases presenting the symptom-complex of chronic enlargement of a part with smooth or roughened skin, with or without ulceration, and microscopically characterized by increased connective-tissue formation with lymphatic dilatation (or new growth), the term elephantiasis has been applied. This all-inclusive and meaningless term has been used to include this condition whether the underlying etiological factor would appear to be antenatal, mechanical obstruction by removal of the lymph nodes draining the part, recurrent streptococcic infections, tuberculosis, syphilis, so-called tropical forms due to the *filaria sanguinis hominis*, or the bilharzia. It will be seen then that the term elephantiasis is applied to a clinical manifestation that is constant only in a very general way either in macroscopic or microscopic appearance and having a most variable etiology. The same may be said of the term esthiomene, though its use is restricted in application to the vulva. It would seem logical, therefore, to restrict these terms to a condition that has a definite pathology and etiology, or so to qualify the term as to give an adequate conception of the condition considered, or perhaps to discard the terms

⁶⁵ Medical Journal of Australia, 1919, i, 111.

⁶⁶ Ibid., p. 172.

altogether. This latter Gallagher⁶⁷ has done in applying the term "chronic syphilitic induration of the vulva" to the cases that he has presented. They are elephantiasic in gross appearance, they may be called esthiomenes, if that term is to be restricted to the cases in which syphilis is the causative factor, but they are syphilitic in origin, are chronic in their course, and their structure is of an indurative, edematous type. He reports four cases in detail and states that on removal all the tumors showed a marked tendency to bleed, the bases being very vascular. There seemed to be a marked arterial supply and a noticeable absence of veins. The tumor base had an almost characteristic pearly white appearance which exuded a clear serum on pressure. Histologically the specimens showed so striking a similarity in appearance that a description will suffice for all. Thickening of the surface epithelium with hypertrophy of the papillæ were the noticeable changes in the skin. Underneath these was a noticeable productive inflammation, lymphocytes, plasma cells and eosinophiles being present. Increased fibrous tissue with edema and enlarged lymph spaces are noted which latter are infiltrated with lymphocytes and plasma cells. The bloodvessels show perivascular infiltration. There are giant cells but no caseous masses. It is Gallagher's belief that a radical removal of the growth with a complete and thorough cauterization of the ulcerated areas—cauterization a second time if need be—with intensive antisyphilitic medication will effect a cure in these cases.

THE FEMALE URINARY SYSTEM.

Renal Pain. Kidney pain is one of the commonest complaints with which the urologist is confronted and it is of great interest to the gynecologist as well. The pain may be localized in the loin or abdomen or radiate widely, and frequently neither the x-ray nor urine analysis will give any clue. In order to determine the causes of renal pain, Harris⁶⁸ has analyzed and studied 170 of his cases which presented this symptom and found that in 52, or 30 per cent., of the cases, the pain was caused by calculi in the kidney or ureter. In 18 cases renal tuberculosis was the cause of the pain, while 32 patients had gross suppurative lesions of the kidney. This leaves 68 patients with renal pain but without any gross infection, in whom the nature of the lesion was not immediately apparent, but in the vast majority of these cases, the pain was ultimately found to be due to some form of ureteral obstruction, most commonly a stricture of the ureter. Harris believes that the diagnosis can and should be made in the early stages of the disease by means of the cystoscope and the ureteral catheter, or even using pyelography, if necessary, because if the diagnosis is made early in the disease, we can expect to cure the patient without sacrificing the kidney. Movable kidneys, on the other hand, should not be subjected to operation unless their causal connection with the existing pain can be unequivocally established. This is a very important statement as it has been proved many times

⁶⁷ Surgery, Gynecology and Obstetrics, 1919, xxviii, 482.

⁶⁸ Medical Journal of Australia, 1919, i, 41.

that renal pain is seldom caused by mobility of the kidney and in many cases more harm than good is done by operative fixation of such kidneys.

Roentgenographic Diagnosis in Renal Tuberculosis. The roentgenographic data in renal tuberculosis are regarded of such importance at the Mayo Clinic, that, according to Braasch and Olson,⁶⁹ it is a rule to make a complete roentgenographic examination of the urinary tract in every case in which renal tuberculosis is suspected. The frequency with which positive data may be obtained in the roentgenogram is evidenced by the fact that in the years 1916 and 1917, 131 patients were operated upon for renal tuberculosis, and roentgenographic examination of the urinary tract had been made in all. Of this number, positive shadows suggestive of urinary tuberculosis were found in 30 patients, a percentage of 22. It may be stated therefore that, approximately one out of five cases with renal tuberculosis will have positive roentgenographic data of definite diagnostic value. Such data are of particular diagnostic value when, because of the contracted condition of the bladder or impassable stricture of the ureter, the cystoscopic findings are inadequate or when the cystoscopic findings are not typical of renal tuberculosis. Furthermore, they are of especial value when the clinical findings are not suggestive of renal tuberculosis or of any involvement of the urinary tract, as may occur with a closed tuberculous pyonephrosis. The roentgenographic shadows are caused by the deposit of calcium in the tuberculous area and may assume a variety of forms. To one who has had considerable experience in roentgenographic interpretation, such shadows will have characteristics that are usually recognized and may be differentiated from a stone shadow by (1) the variability in its density, as the shadow is irregularly concentrated in its different portions, (2) by a shadow of lesser density throughout than that usually observed with stone, and (3) by its irregular and indefinite outline. The calcareous area may, however, simulate the shadow of a renal stone in every particular, and it may be quite impossible to differentiate it without further clinical data. The same is true of renal stones that are occasionally seen of such consistency that the shadow will be fully as irregular and hazy in outline as a typical tuberculous shadow. It may be said however, that approximately 75 per cent. of tuberculous renal shadows may be recognized as such in the roentgenogram.

Renal Fluoroscopy at the Operating Table. Braasch and Carman⁷⁰ comment upon the difficulty involved in many cases of renal stone of actually finding the calculus after the patient is on the table and the kidney is exposed. It is apparent that a more accurate method of examination of the kidney at the time of operation is desirable since the usual roentgenographic examination at the operating table is an awkward procedure and requires too much time. It would seem that if fluoroscopic examination, when the kidney is brought out of the wound, could be made practical, the various difficulties surrounding lithotomy would be readily overcome. Taking advantage of the recent improvement in fluoroscopic apparatus, they have employed for this purpose a

⁶⁹ Surgery, Gynecology and Obstetrics, 1919, xxviii, 555.

⁷⁰ Journal of the American Medical Association, 1919, lxxiii, 1751.

machine which is essentially the same as that used in the base and field hospitals of the army, with certain minor changes which make it adaptable to civilian practice. Such an instrument consists of a transformer and autotransformer enclosed in a metal cabinet mounted on large casters for portability. To the cabinet is attached a tube stand with a horizontal arm having universal joints for supporting the tube. The tube is of the Coolidge radiator self-rectifying type, mounted in a lead glass shield. The unit is small and compact, requiring less than $2\frac{1}{2}$ square feet of floor space. It is of light weight; is portable, and has no moving parts which might cause noise and vibration. The current is turned on and off either by a hand or a floor switch. These portable units may be operated from the ordinary lamp socket without special wiring. As an essential preliminary in the technic, the x-ray operator should wear goggles of smoked glass for about fifteen minutes before the observation is to be made in order that he may have the necessary dark-accommodation and retinal perception. The x-ray unit should be placed as close to the operating table as possible and the rays focussed through a small diaphragm so that they will pass through the delivered kidney on the fluoroscopic screen. When the fluoroscopist is ready to make the roentgenoscopic examination, the hooded screen held in the left hand is placed over the eyes and the goggles are removed and the current is turned on by means of a foot switch. In the right hand is held a sterilized metal-tipped rod 18 inches long with which the fluoroscopist accurately points to the stone shadow in the kidney. The exposure is short, requiring little more than a flash and the various details can be arranged so that there is no interference with surgical asepsis.

Value of Water in Nephrolithiasis. In a very interesting article Ochsner⁷¹ relates an unusual experience that he had in his early practice and points out the possibility of obtaining valuable suggestions from patients in certain cases. The patient in question was a manufacturer of steam boilers who had been a sufferer from recurrent renal colic. On asking him whether he had experienced any attacks recently, he stated that he was definitely through with renal colic, and suggested that if the doctors used their intelligence as actively in their profession as boiler manufacturers had to in their business, no one would ever have to experience a second attack unless he had more than one stone in his kidney to begin with. He stated that when his customers complained of their boilers filling up with lime in the form of scales, he advised them to use rain water and this ended the trouble; so on the same principle he drank freely of *distilled water*, and had been free from a recurrence of kidney stone and renal colic. Ochsner immediately tried this treatment on a patient and in the twenty-nine years that followed, the patient never had another attack of colic, although he had been subject to them frequently before. He has made use of this method in an enormous number of cases, always with good results and the practice has been followed by many practitioners who have visited his clinic. While there

⁷¹ Journal of the American Medical Association, 1919, lxxiii, 1105.

is no doubt that the method must have been in use before the boiler-maker discovered it, earlier reference to it seems to have escaped attention, except that the water from certain springs which is almost as free from lime as is distilled water has been used as a prophylactic against recurrence of renal stone from time immemorial.

Indications for Operation in Ureteral Calculi. The discussion of the question whether or not to operate upon a case of ureteral calculus was a much easier task ten years ago than at the present time. This change in viewpoint is in great measure due to the rapid development of the non-operative methods of treatment with which every surgeon should not only be familiar but of which he should give his patient the benefit before operation is considered. As a result of a rather extensive experience in renal surgery, Eisendrath⁷² has formulated some very helpful rules on determining the indications for operation. He believes that operation is indicated when colics recur or infection persists after repeated attempts have been made to deliver the calculus by non-operative methods and there is practically no change in the location of the calculus; also when there are evidences of stricture formation following (a) the spontaneous expulsion of a calculus, (b) or its delivery by non-operative methods, or (c) after a ureterotomy, or when a fistula is present either (a) as the result of perforation of the ureteral wall by a migrating calculus, or (b) above a stricture. Operation is certainly indicated when a severe degree of renal infection is present and the calculus is impacted in the ureter. Whether or not it is necessary to remove the kidney, in addition to the ureterotomy, depends on the degree of involvement of the renal pelvis and parenchyma. Some of these cases are complicated by a peri-ureteral or perinephritic abscess which will require immediate drainage. Calculous anuria cases should be operated upon as soon as the diagnosis of the location has been made. The average period of tolerance is six days. If the calculus is located near the vesical end of the ureter, an attempt to deliver the calculus by manipulation is worthy of a single trial, but one should not lose valuable time by postponing operative interference too long while such an attempt is being made. In cases of either aseptic or infectious hydronephrosis, immediate operation is indicated. As a rule, the degree of dilatation of the renal pelvis is such that a nephrectomy is necessary. If pyelography can be done in such cases, it gives the best picture of the extent of the destruction of the parenchyma. Many of the cases in which an attempt has been made to save the kidney may be benefited by catheter drainage or renal pelvic lavage. Bilateral ureteral calculi alone without concomitant renal calculi occur so infrequently that it is best to consider the two together and in such cases the kidney with the acute complications should be operated upon first. In cases where no complications are present, the kidney with the better function should be operated upon first, although occasionally simultaneous bilateral operation is advisable.

Non-surgical Removal of Ureteral Stones. There has been much written of late years concerning the removal of ureteral stones by non-

⁷² *Annals of Surgery*, 1919, lxx, 192.

operative methods and many different technics have been advocated. In a series of 23 cases which were treated by Merritt,⁷³ the stone was passed in 21 cases after the use of the following procedure. The cystoscope was introduced and the ureter below the stone was dilated with ureteral dilators. After the introduction of 2 to 4 c.c. of a 2 per cent. solution of papaverin or novocainé through a ureteral catheter, the catheter was withdrawn so that the ureteral walls might be infiltrated thoroughly. If a small ureteral orifice obstructed, then ureteral scissors were used to cut the meatus to the desired size. After this, a stiff catheter was passed to or beyond the stone and 2 to 4 c.c. of sterile olive oil were injected. This was followed by the injection of a few drops of a 10 per cent. argyrol solution for its antiseptic value, and it also possibly reduced the soreness from manipulation. The patient, if not in pain, may sit up, but if in pain, large doses of morphine, hot applications and an abundant intake of fluid are indicated. This procedure is employed at intervals of three days if the condition of the patient will permit, the average number of treatments required being three.

Stricture of the Ureter. For several years Hunner⁷⁴ has devoted considerable time to the study of stricture of the ureter and his publications have been of much interest and value. In the study of about 500 cases of ureteral stricture occurring in his practice during the past four years, he has arrived at a number of important conclusions. Some of these are startling because of their newness, but none of them would have been presented, had he not had full confidence that time and further investigation on the part of other men would give them support and verification.

He believes that ureteral stricture is one of the commonest causes of abdominal symptoms in women. Unrecognized ureteral stricture leads to more needless and fruitless abdominal operations than any other pathological condition. These operations in the probable order of frequency are for appendicitis, ovarian disease, uterine and pelvic disorders, floating kidney, especially the type with hydronephrosis, gall-bladder investigations, and abdominal explorations for intestinal obstruction and adhesions. Ureteral stricture, according to Hunner, is the cause of more kidney pathology (excluding conditions usually classified as medical) than any one factor. It accounts for the majority of hydronephrosis cases, and thus indirectly for many cases of floating kidney and of pyonephrosis. The majority of pyelitis cases have ureteral stricture and obstruction as a basis. Most cases of pyelitis of pregnancy and of the puerperium depend upon stricture, as do many cases of pyelitis in children. Some cases of albuminuria and eclampsia leading to premature childbirth are due to stricture. Most cases of stone in the ureter and probably many cases of stone found in the kidney and bladder arise in an area of ureteral stricture. It is probable that urinary stasis due to stricture is the predisposing factor in many cases of stone arising in the kidney and of recurring kidney stone occurring after operation. Many, if not the majority, of cases of so-called

⁷³ Southern Medical Journal, 1919, xii, 143.

⁷⁴ Ibid., 396.

essential or idiopathic hematuria are due to ureteral stricture. Finally, Hunner states that time and experience have amply verified his original theory that most cases of ureteral stricture and many cases of chronic urethritis are due to focal infection. In order to arrive at an accurate diagnosis of this condition, a careful history must be taken in every case and this must be followed by most painstaking physical examination. The urine analysis is then closely studied after which the newer methods of diagnosis are employed, including roentgenography, cystoscopy and ureteral catheterization, especially with the wax bulbed catheter.

Postoperative Cystitis. The frequent occurrence of cystitis after pelvic operations, especially after extensive plastic operations involving the anterior vaginal wall, makes the subject of great importance. From the observations of a considerable number of cases, Watkins⁷⁵ is firmly convinced that the so-called postoperative catheter cystitis does not usually result from infection from the catheter but from the presence of an increased amount of residual urine. As an illustration of this contention, he mentions the case of a woman, aged forty-five, who consulted him for uterine prolapse, a large cystocele and a lacerated perineum. The uterus was about twice its normal size. She had the usual symptoms of prolapse and also had some vesical irritability. Examination of the urine showed cystitis, and the use of the catheter immediately after urination showed on an average of one and a half to two ounces of residual urine. The lesions were corrected by a modified transposition operation, including a high amputation of the uterus, and suture of the resulting stump to the fascia underneath the trigone of the bladder. This operation resulted in considerable traumatism to the bladder, which was already infected and which had defective muscles as the result of having been overstretched and displaced. Following operation she had a partial bladder paralysis which is common and should be expected in such a case and although she was able to pass some urine, it was nearly two weeks before the residual urine became normal in amount. For several years Watkins has given careful attention to the question of increased residual urine, with the result that postoperative symptoms and findings are almost invariably proportionate to the amount of the residual urine which the patient carries. The fact that bacteria are often eliminated through the kidney means that bacteria very frequently travel through the bladder cavity and in the case of the presence of a considerable amount of residual urine, infection is very liable to result. Therefore it has become his custom to test for residual urine as soon as symptoms referable to the bladder develop, and to catheterize at least once daily until the amount of residual urine becomes normal, which is a half to one dram. Instillations of silver are used after catheterization, commencing with a weak solution of an eighth of 1 per cent. and gradually increasing the strength should progress be unfavorable. Benzoic acid in doses of five grains four or five times daily is given in case the urine is neutral and as soon as the urine becomes acid, urotropin is ordered, commencing with five grains three times a day and

⁷⁵ Surgical Clinics, Chicago, February, 1919, p. 213.

increasing the amount five grains each day until formalin appears in the urine. Then the amount is again diminished until a weak reaction of formalin is obtainable. If the urotropin causes an acute irritation, it is stopped at once and large doses of sodium citrate are given until relief is obtained. The result of this treatment has been that the patients, when finally discharged, are cured of the cystitis, although in occasional cases it is necessary to continue some bladder treatment after the patient has left the hospital.

A Study of Bladder Function. Incomplete evacuation of urine from the kidneys or bladder is not infrequent, and Curtis⁷⁶ believes that it deserves more investigation than has been accorded it. He has been studying that phase of the subject which has to do with failure to empty the bladder, using for this purpose the bladders of 22 male rabbits, which were paralyzed by cutting the spinal cord. This injury produces a bladder paralysis entirely analogous to that which occurs in soldiers consequent to gunshot injuries of the spine and cord. The animals were housed in sanitary cages which permitted immediate drainage of voided urine. The buttocks and genitalia were kept clean through shaving, aided by bathing and applications of petrolatum many times daily. Bladder paralysis was obtained in every case, and vesical distention was present in all except one rabbit which died three days after operation. The degree of distention was moderate in eight; in the other thirteen cases the bladder filled the entire lower abdominal cavity. One rabbit without anatomical obstruction to the urinary flow, died in consequence of spontaneous rupture of the bladder. Extensive vesical erosion or ulceration occurred in nine instances, while hemorrhages in the submucosa were frequent. The ureters of four were not distended and those of three were doubtful, whereas fifteen were unquestionably dilated, some to an extreme degree. Of the dilated ureters, both were involved eight times, the left alone five times, the right alone twice. The kidneys were of much interest. Of the 22 cases, 7 were normal and 15 pathological. The microscope revealed that 7 had nephritis, and 6 showed notable round-cell infiltration. Intense congestion with more or less hemorrhage was frequent. Bacteriological study showed that infection was evident in 12 of the 22 cases. Of these, the mucosa of one ulcerated bladder was packed with polynuclear leukocytes, but bacteria were not obtained. In the other 11 infected cases many bacteria were found in smears and cultures; 1 of them must be excluded from consideration because there was an associated beginning peritonitis, leaving 10 cases of undoubted urinary tract infection with numerous bacteria in every instance.

These experiments upon rabbits indicate that the unrelieved paralyzed bladder offers a twofold menace to health: (1) through frequent infection of the urinary tract due to contamination of static urine, and (2) through back-pressure which distends the ureters, seriously interferes with kidney function and damages the kidney tissue. It would appear advisable, therefore, to maintain the paralyzed bladder in a state of

⁷⁶ Surgery, Gynecology and Obstetrics. 1919, xxix, 24.

freedom from residual urine, thus minimizing the danger of kidney involvement. From a clinical standpoint this study would seem to show that irregularly performed catheterization for retention of urine is unsatisfactory, and patients so treated are subjected to such dangers as accompany the passage of a catheter and at the same time are rendered liable to accumulations of infected stagnant urine. On the other hand, carefully managed catheterization of the bladder which fails to empty spontaneously yields excellent results; the catheter should be regularly passed often enough to prevent vesical distention and its use must be persisted in until daily tests show that residual urine is no longer being retained in the bladder.

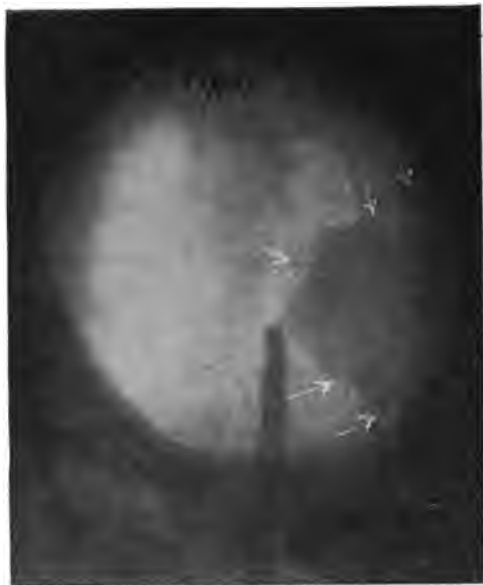


FIG. 72.—Tumor of bladder.

Injection of Air in Bladder Diagnosis. The examination of the bladder for tumors by the expert cystoscopist has been so successful that this modified roentgen method has probably not been developed to the fullest extent according to Pfahler⁷⁷ but there are many cases in which an examination by the cystoscopist is not practical because of pain, inability to pass the instrument, hemorrhage or objection of the patient. The technic that Pfahler follows is to make an anterior and a posterior plate before the injection of air in order to demonstrate the conditions present independent of the air injection. In this way one is able to localize the air or gases which may be retained in the rectum or pelvic colon. The urethral orifice is then cleansed in the usual manner and the largest catheter that is comfortable is passed into the bladder. An atomizer bulb is then attached to a glass connecting tube which in turn is connected to the catheter. After the bladder is emptied, it is distended with air by means of the atomizer bulb until the patient com-

⁷⁷ American Journal of Roentgenology, 1919, vi, 371.

plaints of discomfort. The catheter is then clamped and the pictures are taken, usually making one or more exposures posteriorly and the same number anteriorly. After the exposures have been made, the clamp is removed from the catheter and the air is allowed to flow from the bladder. Gentle pressure should be made in the suprapubic region in order to force all the air from the bladder. Pfahler has never had any bad results from this method and he has frequently succeeded in demonstrating new growths in the bladder as small as a thimble.

Treatment of Bladder Tumors in Women. Kelly⁷⁸ has been making an investigation to determine how best to approach and to deal with vesical papillomata and infiltrating cancers of the bladder wall not yet extensive. Before the days of cystoscopy a certain diagnosis of cancer or papilloma could not be made in the early stages and there was no such recourse as any real surgery of the bladder, beyond a mere incision and drainage for cystitis. Then came the era of free suprapubic openings of the bladder followed by more or less extensive extirpation, with their too frequent recurrences, and now at last with our greater experience and greater familiarity with the diseases of the bladder and better methods of diagnosis, he believes that it is time to inaugurate also yet better methods of treatment, and to hark back in some cases at least to more conservative procedures. According to Kelly, direct vision and direct accessibility through the air-distended bladder is the simplest, speediest and most effective way of reaching intravesical lesions, while fulguration is the most rapid way of destroying pedunculated and limited isolated lesions and is often permanently effective, although it often fails in many cases of disseminated lesions. It always fails in cases of infiltrating lesions and usually aggravates them, but radium is available and successful in all classes of cases and is especially of value in the group where fulguration fails. Radium should be applied directly under inspection to lesions in substantial dosage, say 250 mc. hours per month to an area 2 cm. square and experience has shown that it is better to apply radium in broken dosage, weekly, following and controlling results. It is best applied intravesically, when it reaches the part in concentrated form without the risk of hurting the vagina incurred when the treatment is given through the vaginal wall. With the means now at our disposal of using these newer and most effective agencies in the treatment of vesical tumors by the direct open channels of the dilated urethra and air-dilated bladder, the treatment of vesical neoplasms enters upon a new phase and our effectiveness as urologists is greatly enhanced in dealing with these fairly common, distressing, and formerly often fatal, maladies. Kelly cautions that extreme watchfulness is necessary at three stages in all vesical neoplasms: (1) It is of the utmost importance to get the case under examination and treatment at the earliest possible moment. This can only be done by investigating at once and tracing to its source the slightest urinary hemorrhage. (2) When under treatment, the case must be watched over a period of several months or longer until all trace of the disease has disappeared. (3) All these cases require watching at intervals of at first a few weeks and then of months for several years in order to catch any recurrence at an early stage.

⁷⁸ American Journal of Obstetrics, 1919, lxxx, 328.



DISORDERS OF NUTRITION AND METABOLISM; DISEASES OF THE GLANDS OF INTERNAL SECRETION; DISEASES OF THE BLOOD AND SPLEEN.

By ELMER H. FUNK, M.D.

DISORDERS OF NUTRITION AND METABOLISM.

Nutrition. Since the cessation of the World War it has been possible to gather together the scattered data with regard to the various problems of nutrition in such a way as to be of enormous value in civilian practice in the years to come. Never before the war had students of nutrition, or food experts as they are now called, such opportunities for extended observations on large groups of men under control. More was learned with regard to nutritional problems in the few years of these observations than had existed in the theory of the previous hundred years. Nutritional surveys were never possible before on such a large scale. One of the most interesting of these surveys is the one reported by Murlin and Miller¹ covering the United States Army camps. The following table shows the nutrients and energy consumed per man per day by the troops under different conditions:

	No. of messes.	Protein. Gms.	Fat. Gms.	Carbo- hydrates. Gms.	Fuel value. Cals.
Line troops in active training and in spruce production camps	263	127	120	483	3615
Aviation camps, mechanics only . . .	38	118	119	469	3510
Troops preparing for immediate overseas service	11	128	126	496	3730
Medical troops, excluding patient messes	20	113	124	436	3405
Messes under quarantine, activity of men not restricted	17	125	124	496	3700
Recruits, usually just inoculated . .	36	117	109	435	3275
Average of above 385 messes		124	119	475	3560

To these must be added the nutrients consumed from the Post Exchange and the Canteen which Murlin and Miller found to average 365 calories daily, making the total average daily consumed 3998 calories, or 27 calories per pound. According to Lusk, 3898 calories is the amount required by a mature soldier of this weight in order to maintain his body and to do a forced march on a level road of thirty

¹ American Public Health, 1919, ix, 401.

miles in ten hours, carrying a pack and other equipment weighing 44 pounds. This coincidence is striking. It is evident, therefore, that the soldier in training eats enough every day to do this large amount of work, or provide for the exigencies of unfavorable weather conditions. If the work is not done, he accumulates fat; and, as a matter of fact, the observations at Camps Devens, Grant, Dodge and Funston indicate an average gain of $7\frac{1}{2}$ pounds in three months. It would not be proper to regard this gain as entirely consisting of fat, however, since there is undoubtedly, at least in the case of men from sedentary occupations, considerable "muscling up." There is also increase in stature, or "straightening up," of the younger men.

The nutritional survey of the army camps demonstrated the fact previously known empirically, namely, that there is a larger consumption of food by men doing equally hard muscular work in cold weather than in warm weather. Murlin and Miller also discuss the protein factor in the diet which has been a moot point to students of nutrition. They state that the amount of protein, which in general is held to be sufficient to repair all the wastes of the body and to supply an adequate reserve, is 13 per cent. of the total energy intake. It seems to be a matter of indifference to the muscles whether they receive their energy from carbohydrate or from fat, except that carbohydrate yields its energy more rapidly than does fat. Hard muscular work, therefore, can be done on a high carbohydrate diet or upon a high fat diet. It is of general experience, however, that muscular work is done *with less effort* if there is a plentiful supply of carbohydrate. Moreover, it is well known that carbohydrate is a cheaper source of muscular energy than is fat. All the requirements for training of soldiers, therefore, would be met by a dietary supplying 12.5 per cent. of the total energy in the form of protein, 25 per cent. in the form of fat and 62.5 per cent. in the form of carbohydrate. This distribution has been fixed upon as approximating the ideal for the training camps, the exact proportion of 1:2:5 having been chosen as a matter of convenience in devising a mechanical means of balancing the dietary. The following tables will prove valuable for reference as showing the rations of the various armies under training and field conditions.

TRAINING RATIIONS.

Ration.	Protein.	Fat.	Carbohyd.	Protein.	Fat.	Carbohyd.	Total.	Protein.	Fat.	Carbohyd.
	Gm.	Gm.	Gm.	Cal.	Cal.	Cal.	Cal.	%	%	%
British Home:										
May, 1918	124	136	419	507	1268	1706	3483	14.6	36.4	49.0
Canadian Training:										
Sheet No. 40,										
July 23, 1918	107	118	344	439	1097	1410	2946	14.9	37.2	47.9
French Normal:										
March 29, 1918	138	98	467	566	911	1915*	3604	15.7	25.3	59.0
Italian Territorial:										
Feb. 1, 1917	127	38	469	521	353	1923	2797	18.6	12.6	68.8
U. S. Garrison:										
A. R. 1221,										
July 16, 1918	147	174	643	605	1619	2635	4859	12.5	33.3	54.2
U. S. Training Ration:										
(proposed)	127	135	575	520	1254	2358	4132	12.6	30.3	57.1

* Includes 250 c.c. wine equals 212 calories.

FIELD RATIONS.

Ration.	Weight			Fuel value			Total	Distribution		
	Pro- tein.	Fat.	Carbo- hyd.	Pro- tein.	Fat.	Carbo- hyd.		Pro- tein.	Fat.	Carbo- hyd.
	Gm.	Gm.	Gm.	Cal.	Cal.	Cal.	Cal.	%	%	%
British Field: May, 1918	156	153	441	640	1423	1808	3871	16.5	36.8	46.7
British Field and Trench: May, 1918	157	166	485	644	1544	1989	4177	15.4	37.0	47.6
French Strong: March 29, 1918	150	105	509	615	977	2407*	3999	15.4	24.4	60.2
Italian Combating: Feb. 1, 1917	131	45	535	535	419	2196	3329†	16.9	13.4	69.7
U. S. Trench, adopted Nov. 1, 1918: (Garrison and additions) Nov. 1 to March 31 incl. . .	162	209	594	664	1943	2435	5042	13.1	38.6	48.3
Apr. 1 to Oct. 31 incl. . . .	145	175	594	594	1627	2435	4656	12.8	34.9	52.3

* Includes 375 c.c. wine equals 320 calories.

† Includes wine equivalent to 179 calories.

In connection with Murlin and Miller's observation that canteen purchases on the part of soldiers, consisting of chocolate, soft drinks and pastry, amounted to a daily average of about 365 calories, it is interesting to note Benedict and Benedict's² demonstration of the surprising caloric value of foods taken between meals. These observations dealing with civilian life show that there is a group of materials frequently eaten as extras by children and adults between meals and at lunches which have a considerable caloric value. They investigated such substances as olives and olive products, sardines, nuts, potato chips, doughnuts, confectionery (such as caramels, nougatines, chocolate almonds, peppermints, etc.). In view of their extensive consumption by children, the Benedicts have also determined and report here the caloric content of a large number of candies popularly sold under the name of "penny goods," that is, sold in portions costing one cent. each. They likewise include partial reports on cream cheeses, popcorn and crackers, including pretzels, and finally they report the average helpings of granulated sugar as measured by seventeen members of the laboratory staff, as well as weights and sizes of various lump sugars. The calories of olives range from 1.147 to 1.553 per gram. The caloric values per gram of the so-called ripe olives, range about 2.4 calories per gram, due to the extra fat. A can of imported sardines will yield not far from 500 calories, and a can of American sardines will yield from 221 to 533 calories. The high fat content of nuts accounts for their high caloric value, which runs in all cases not far from 7 calories per gram. Owing to the fat content of potato chips, their caloric value is, on the average, 5.9 calories per gram. The caloric value of doughnuts varies with the fat content, ranging from 4.4 to 5.1 calories per gram, averaging not far from 200 calories per doughnut. The caloric value of crackers and pretzels per gram is not far from the caloric value of starch, *i. e.*, 4.2 calories. The caloric value of caramels is somewhat over 4 calories per gram. The caloric value of chocolate-

² Boston Medical and Surgical Journal, 1919, clxxxi, 415.

coated candies for the most part runs above 4 calories per gram. Not far from 50 to 60 calories are commonly secured in penny candies for one cent. Popcorn candy has a caloric value of 4.030 calories per gram; Philadelphia cream cheese, 3.654 calories per gram; Neufchatel cheese, 2.056 calories per gram. The average teaspoonful of sugar furnishes from 29 to 35 calories.

In contrast with the nutritional survey among men, as described by Murlin and Miller, are the observations of the food requirements and energy expenditure among women as reported by Rosenheim.³ He concludes that the figure for women is about 7 per cent. lower than that for men. Under working conditions and exercise the following increments of heat production occurred: Light work, 72 per cent.; medium hard work, 109 per cent.; hard work, 181 per cent.; walking, 274 per cent. It may come as a surprise to learn that the energy expenditure during one hour's horizontal walking is in all cases higher than that of even the hardest work on the lathe. Women expend about the same amount of energy as do men in horizontal walking, the "maximal economic velocity" being about 3 miles an hour (or 80 meters a minute). As has been demonstrated in the case of athletes, training works for economy of energy expenditure. A waitress is likely to walk with greater physiological economy than a person of sedentary habits.

Harris and Benedict⁴ found that there is a reduction in the metabolic rate in both men and women with increasing years, the decrease in heat production per kilogram of body weight per year being 0.112 calorie in men and 0.124 calorie in women.

Another nutritional survey of large proportions is that involving the Danish people and reported by Hindhede⁵ from the Nutrition Laboratory at Copenhagen. This country did not seem to have been harmed by the stringent food restrictions; in fact, according to Hindhede, there was a definite reduction in the mortality-rate during the period of greatest restriction, that is from October 1, 1917, to October 1, 1918. It was a low protein experiment on a large scale, about 3,000,000 subjects being available. The diet consisted mostly of milk, vegetables and bran. The unusually large amount of bran consumed by the Danish people was a striking feature of their war diet. It demonstrated that bran makes excellent food, which confirms the findings of Osborne and Mendell.⁶ These observers found that bran can take the place of meat and eggs when mixed with white flour in the dietary for animals. Hindhede states that man should likewise replace much of the meat and eggs by whole bread containing bran. Hindhede insists that if Central Europe had adopted a similar diet he doubts if anyone would have starved. He evidently is a very ardent advocate of the low-protein diet. Granting that many people do overindulge in proteins, it should not be forgotten that there might be an unsafe minimum protein diet. Hoesslin⁷ found among those who had been for a long

³ Proceedings of Royal Society, 1919, xci, 44, Sec. B.

⁴ Publication 276, 1919, Carnegie Institution of Washington.

⁵ Journal of the American Medical Association, 1920, lxxiv, 381.

⁶ Journal Biological Chemistry, 1919, xxxvii, 557.

⁷ Arch. f. Hygiene, 1919, lxxxviii, 147.

time on an enforced low protein diet, with losses of weight from 40 to 55 kilograms and with evidences of malnutrition, war edema, etc., that considerable difficulty was encountered in securing any gain in weight under any diet unless protein was liberally furnished. This observation, in contrast to normal individuals where fats and carbohydrates may have a protein-sparing action indicates that when a rock bottom nitrogenous exchange level is reached, protein is absolutely necessary for a gain in weight. This may explain why certain of the German physiologists, and especially Rubner, are stressing the need of more meat—more protein—in order to overcome the general state of malnutrition which exists among those people.

McCollum⁸ and his collaborators have this to say with regard to the low-protein diets in animals. Experience indicates that with such diets animals do not remain in a state of well-being even when the content of protein is sufficiently high to maintain in certain individuals the initial body weight over as much as 10 per cent. of the normal span of life. They believe that health and vigor are promoted by a liberal intake of protein of good quality better than by any diet in which there is a tendency toward parsimony with respect to this dietary factor. It should not be lost sight of, however, that there are other factors in nutrition which are of equal importance with protein, and that if the optimum well-being is to be attained the diet must be rightly constituted with respect to all its parts. In addition to this, the prompt elimination of the fecal residues is essential and is a great relief to the tissues of the entire body.

Botulism. During the past year the editorial columns of the *Journal of the American Medical Association* have been active in the dissemination of knowledge with regard to *botulism* which has come into the foreground as a result of several outbreaks of food poisoning in different sections of the country during the past year. The term botulism, or sausage poisoning, is inappropriate to this form of bacterial intoxication as it occurs in the United States, since canned string beans, asparagus, corn, apricots, olives and cheese have been implicated at various times and places, while meat products have seldom been connected in such instances. As pointed out⁹ there is no doubt that the early statements of Ermengem, the discoverer of *Bacillus botulinus*, about the low heat resistance of this organism are incorrect if applied to all conditions or all strains. Most of the American strains, so far from being killed by heating to 80° C. for one hour, will withstand much higher temperatures, some even resisting the temperature of boiling water for a considerable period. The history of the canned foods implicated in botulism poisoning shows that the spores of *Bacillus botulinus* pass through the ordinary processes of household canning without destruction. It seems to be a fact that, as far as recorded cases go, only two or three instances of botulism poisoning have been traced to factory canned goods, as against a much larger number attributed to foods prepared in the household.

⁸ *Journal of Biological Chemistry*, 1919, xxxviii, 113; Editorial, *Journal American Medical Association*, 1919, lxxiii, 989.

⁹ Editorial, *Journal of the American Medical Association*, 1919, lxxiii, 845.

Whether this difference is due to the superior germicidal efficiency of factory methods of heating or to the circumstance that spoiled or swelled canned goods are more likely to be eliminated in the course of ordinary trade procedures or to a combination of these factors cannot be definitely established at this time. It does not seem, however, that we are justified in asserting that a danger is entirely absent because it is exceedingly slight.

Weinzirl¹⁰ has studied the relation of spoiled canned goods and botulism, and summarizes his experience as follows:

A. *Bacillus botulinus* was not found in 1018 samples of commercial canned foods, although careful search was made for it. The samples included spoiled, experimental and marketable goods, and practically every variety was represented.

B. All the literature investigated did not reveal a single instance of *Bacillus botulinus* having been found in factory canned food in the United States. Since our annual consumption must approximate five billion cans of such foods, it is truly remarkable that not a single instance should be reported in our scientific literature. It is all the more remarkable because botulism exhibits highly characteristic symptoms.

C. From the analyses made and from the evidence presented in the scientific literature, the natural conclusion is that *Bacillus botulinus* and its toxin are not found, or are exceedingly rare, in factory canned foods.

After Weinzirl's report a paper appeared by Thom, Edmondson and Giltner¹¹ reporting an outbreak in Boise, Idaho, of botulism from canned asparagus. Four persons died as a result of the disease. Detailed bacteriological studies were made by these observers who found a strain of the *Bacillus botulinus* whose spores were very resistant to heat. Bacilli freed from toxin by washing or spores freed from toxin by heat do not produce symptoms of poisoning when fed or injected, but have been recovered in virulent form from feces of fed animals. The toxin is destroyed by heating to 75° C., or by heating for ten minutes to 73° C. All cultures of the Boise organism have a characteristic and offensive odor which was clearly evident in the canned material connected with this case. This has been referred to as butyric but, certainly, in many foodstuffs would be inseparable from the putrefactive group of odors. Decomposition occurring in a can or jar properly packed, exhausted and sealed is necessarily anaërobic. When physical evidence of such decomposition is present, the material should be destroyed, not eaten. The clinical reports of the cases are of interest and I am quoting in full from Thom, Edmondson and Giltner's paper.

CASES 1 and 2 (report of Dr. S. M. Forney). About noon of January 8, 1919, I was called to see two colored people, a man and a woman. From the woman I learned that both she and her husband awoke feeling normal on that morning. A few hours later her husband began

¹⁰ Journal of Medical Research, 1919, xxxix, 349; Journal of the American Medical Association, 1919, lxxiii, 789.

¹¹ Journal of the American Medical Association, 1919, lxxiii, 907.

to feel a choking sensation in his throat; his voice became husky and he had a feeling of weakness (paralysis) beginning in the feet and creeping upward. At the time I called (2 P.M.) he was unable to talk; but he could understand and answer by shaking his head. He had no pain; breathing was labored; pulse rapid. The wife was beginning with the same symptoms, but these were not as yet so marked. She complained of a choking sensation and swelling in her throat but was able to tell what they had eaten the night before, nothing since, etc. They were ordered to the hospital. Before the ambulance arrived the husband died and the wife died on the road to the hospital, apparently choked to death. There were seven negroes at the meal. Five ate asparagus, four of whom died within thirty-six hours. The fifth escaped though he ate heavily of asparagus. I saw only the husband and wife mentioned, but the others died as these did.

I afterward learned that the asparagus, which we suspected at the time, was home-canned, cold-pack method with single sterilization, and that at the time it was opened one woman remarked that it smelled spoiled. The host answered: "It can't be; I canned it myself."

CASE 3 (report of Dr. H. M. Holverson). In the case of C. H., she, with a party, ate of canned asparagus at 4.30 P.M., January 7, 1919. It was noticed at the time of eating that the asparagus did not taste just right. No symptoms were noted until 9 o'clock of the following morning, when she first noted a sensation as though the tongue were swollen. She was not at all alarmed until 12 o'clock, when she heard that two others of the party were severely sick, then I was called.

At the first call at 12 o'clock I found considerable paralysis of the glossopharyngeal nerve. The articulation was distinct, although it was an effort for her to talk. There was no disturbance of the vision except that objects appeared to move to the left side. She could walk but veered to the left for the reason, as given by her, that the objects for which she started seemed to move over to the left and she followed the objects. There was no pain. She had a settled conviction that she would not live. There was no distress of mind about her own condition. Her only worry seemed to be that her husband, who was present at the dinner party, might be taken sick on his car, he being a Pullman porter. I immediately placed her on drop doses of gelsemium. For about an hour there seemed to be some improvement.

At 3.30 P.M. the paralysis had progressed to such an extent that there was drooping of the eyelids and a feeling of slight numbness with tension of the right arm. All the muscles were involved, showing complete involvement of the right brachial plexus. Speech was much more labored, articulation distinctly thickened. Swallowing had become difficult, the gait had become distinctly swaying in character. The mind was clear; there was no distress, mentally or physically.

At 5 o'clock the hypoglossal nerve had become affected; swallowing of liquids or solids was impossible. There was a continual flexing of the right hand and beating of the arm on the arm of the rocker in which she was sitting to relieve the feeling of deadness, as she described it, in the arm. The speech was very much thickened and required great effort, although she could deliver a full sentence at a time.

At 8 P.M. there was complete paralysis of the tongue. The paralysis of the muscles of the throat and face had progressed to such an extent that she could only whisper a word at a time. At this time there seemed to be a beginning paralysis of the pneumogastric nerve. Breathing began to be labored, heart action was slow, being at this time about 50. The eyes could only be partly opened and that only by an effort of throwing back the head.

At 10 o'clock she ceased all efforts at speaking; the respirations were slow and labored, twelve per minute. The pulse was 40. From this point all respiration became slower with a sort of gasping sigh until 1.30 A.M., when death took place (January 9, 1919).

There was no pain at any time, and the paralysis of the muscles of respiration did not give any distress in breathing, although it was labored. The patient's mind was clear at all times until she lapsed into unconsciousness, about 10 o'clock.

Botulism from eating *canned olives* has been freely described in the lay press during the past year. Armstrong, Story and Scott¹² report an outbreak in Canton, Ohio. The cases were confined to the chef, waiters and diners of one table at which ripe olives, nuts and candy had been substituted for regular items of the menu. Seventeen persons ate or tasted the olives; 14 became definitely ill, 7 cases ending fatally; 3 showed no definite symptoms. None were ill who did not partake of the olives. Those who ate the most olives died first, while among those who recovered, the severity of illness bore a close relation to the numbers eaten; 3 who developed no symptoms ate the least of all. Two diners, who took a relatively large amount and recovered, had partaken freely of alcohol during the evening. The olives were packed in a sealed glass jar, but the vacuum had been accidentally destroyed. They were placed in three table dishes; the contents of two dishes were washed under the tap and drained, the third dish was unwashed. This factor, in the opinion of the authors, may explain the death of one person who ate half an olive, while another recovered after eating two olives. The symptoms were very similar in all cases, varying mainly in severity: Headache, diplopia, dimness of vision, and slight vertigo were the most common phenomena. The authors believe that certain diagnostic pitfalls are present in all cases. Botulism may be mistaken for poisoning by mushrooms, wood and ethyl alcohols, cerebral hemorrhage or syphilis, and hysteria; only the occurrence of attacks in others makes the matter clear.

TREATMENT. McCaskey¹³ in discussing the treatment of *Bacillus botulinus* poisoning states that the treatment, as in most infectious diseases, must be either general or specific in character. In regard to the former, perhaps the only thing needing special emphasis is the importance of active catharsis. It should be a general rule in all suspicious cases of food poisoning to clear out the intestinal tract as quickly and as thoroughly as possible. Since fatty substances apparently combine with the toxin and thereby attenuate, if not actually

¹² Public Health Reports, 1919, xxxiv, 2877.

¹³ American Journal of Medical Sciences, 1919, clviii, 57.

destroy its virulence, the logical cathartic is a full dose of castor oil or a laxative of a similar nature. In those cases in which it is possible to use antitoxin, this method holds hope of benefit. Animal experimentation and clinical experience would seem to indicate, according to McCaskey, that antitoxic serum should be used early in cases of suspicious food poisoning, without waiting for confirmation of the diagnosis by the laboratory. It might thus be possible to prevent such tragedies as the ones recorded in the outbreak which he reports. He suggests, as a practical way of rendering available antitoxin for this purpose, that Government distribution should be possible through some department such as the Bureau of Animal Industry. He doubts if antitoxin can ever be furnished commercially because of the fewness of the outbreaks and their far removal from each other.

Carotinemia is the name applied to a condition characterized by a yellowish discoloration of the skin, resembling mild icterus and caused by a diet rich in carotin (carrots, spinach, egg yolk, oranges, etc.). Although described as a new clinical picture by Hess and Myers,¹⁴ it has, no doubt, existed for a long time unrecognized and confused with mild grades of icterus. Neither can it be rare, considering the wide distribution of carotin in foodstuffs. It is a disturbance which occurs when the dietary for a long period contains a large quantity of vegetables. In fact, Hess and Myers became acquainted with the condition as the result of a dietetic study of two children who were developing a yellowish complexion and were found to be receiving a daily ration of carrots in addition to their milk and cereal. None of the other infants under observation manifested the yellowish discoloration. The addition of carrots to the dietary of the two other children produced, in two and five weeks respectively, a similar yellowish discoloration. On the omission of the carrots from the dietary, the skin gradually lost its yellow color, and in the course of some weeks regained its normal tint. The discoloration of the skin is accompanied by a similar yellow tingeing of the blood serum and the plasma. The pigment in the blood was identified as carotin. In cases of carotinemia the urine was colored yellow as well as the serum. When a small quantity of concentrated carotin was ingested, the pigment appeared rapidly in the urine. These observations are of interest in view of the fact that clinicians, as well as physiologists, consider that the urinary pigments are formed solely from bile or its derivatives.

As the pigment is more toxic and leads to no physiological disturbance, it is readily overlooked or attributed to some minor derangement of the liver or intestinal tract.

Diseases Due to Deficiencies in Diet. THE VITAMINS. The *vitamin hypothesis* has passed from the phase of novelty which provoked on the one hand undue enthusiasm, and on the other uncritical opposition, into its present one of fairly general acceptance and which allows of a clearer understanding of the etiology and treatment of the food-deficiency diseases. Hopkins¹⁵ stated before the Royal Society of Medicine

¹⁴ Journal of the American Medical Association, 1919, lxxiii, 1743.

¹⁵ Lancet, 1919, cxcvii, 979.

that the vitamins have eluded us for so long, for the earlier experimental students of nutrition never really used pure foodstuffs. The facts concerning scurvy might have led to the realization of the truth much sooner, had not the fashions in opinion helped to obscure the issue. Scurvy, continues Hopkins, is a clear example of a deficiency disease, but even a worker like McCollum denied this for a time and ascribed it to intestinal stasis. The work of the Lister Institute, the production of scurvy in monkeys, and the quantitative evaluation of foodstuffs in respect of their value against scurvy, all put the matter beyond a doubt. With regard to infantile scurvy, the question of dried milk is an interesting one. The infant does not, as a rule, develop scurvy on a dried milk diet, although some proportion of the antiscorbutic vitamin in the milk has been destroyed. It is possible that the infant starts life endowed with an excess of the vitamin. In beriberi it is questioned whether the antiberiberi vitamin is the sole factor. Certain Japanese evidence suggests that it is not.

Rickets, according to Hopkins, is less well established as a deficiency disease, but is of supreme national importance. The work of E. Mellanby is convincing of the all importance of a factor connected with fats, but there may be other complicating agencies. The nature of the fat in the diet makes the difference between rickets and no rickets in experimental work, at any rate, and other factors are of minor importance. Investigations into accessory food factors may be complicated by the fact that the specific substances may be consumed without being absorbed. There is an increasing probability that the function of accessory food factors is connected with the stimulation of internal secretions. The response of the animal to the amount of one factor varies with the amount of other factors in the diet and will also vary with the rate of metabolism. To the mind of an experimentalist there is more sound evidence for the connection of rickets with a deficiency in a special type of fat than for any other explanation. Pritchard has advanced the theory that rickets is due to an acidosis following general malnutrition, but the blood of rickety patients needs much more investigation before the existence of such an acidosis can be established.

An xerophthalmia occurs in rats fed on a diet deficient in special fat, and this is regarded by McCollum as a deficiency disease. Its incidence is puzzling, as it does not occur always in animals fed on animal fats, but only in some groups. When it does occur it clears up when animal fat is given. Among children in Denmark during the period of the most wholesale export of butter, a similar xerophthalmia occurred. It was investigated by Bloch, who was forced to the conclusion that the curative factor was animal fat.

With regard to pellagra, Hopkins states that the evidence points to its being due not to the lack of vitamin but to some other deficiency in the diet. When, many years ago, a group of rats was fed on a tryptophane-free diet, symptoms developed which might have been pellagrous, but it has not been possible to repeat this result.

The fact that food-deficiency diseases are being more closely studied in civil life and especially since they are rife in many sections of poverty-

stricken central and eastern Europe, makes it necessary that physicians generally should familiarize themselves not only with the general problem of nutrition, but with those accessory food factors or vitamins which seem to play such an important role in these diseases.

The report of the British Committee appointed jointly by the Medical Research Committee and the Lister Institute for the guidance of those engaged in food relief to famine-stricken districts¹⁶ is of such practical importance that we are quoting it in considerable detail. Of first importance is the knowledge of the distribution of the accessory factors and in this regard the committee reports as follows:

1. Antineuritic or antiberiberi factor ("water-soluble B" growth factor of the Americans). This vitamin is widespread, and is found to some extent in almost all natural foodstuffs. Its principal sources are the seeds of plants and the eggs of animals, where it is deposited, apparently, as a reserve for the nutrition of the young offspring. Highly cellular organs, such as the liver and the brain, contain considerable amounts of this vitamin; flesh contains comparatively little. Yeast cells are a rich source; so also are yeast extracts, *e. g.*, "marmite." In the case of peas, beans and other pulses, this vitamin is distributed throughout the seed, but with the cereals it is concentrated in the germ (embryo) and in the peripheral layer of the seed which in milling is peeled off with the pericarp and forms the bran.

Beriberi is occasioned by a diet composed too exclusively of cereals from which germ and bran have been removed by milling, as in the case of polished rice or white wheat flour. The disease is common where polished rice is the staple article of diet to an almost entire exclusion of other foodstuffs. It is rare, though not unknown, where white bread is eaten, because the consumption of this type of cereal food is usually accompanied by a sufficiency of other foodstuffs containing the essential principle. It is unknown where rye bread is the staple food, because in the milling of rye there is no separation of the germ.

2. The fat-soluble A growth factor or antirachitic factor: The main sources of this vitamin are two in number: (a) Certain fats of animal origin; (b) green leaves. The most notable deposits of this factor are in cream, butter, beef fat, fish oils (for example, cod-liver oil, whale oil), egg yolk. It is present in very small or negligible amount in lard (pig fat) and in vegetable oils, as, for example, linseed oil, olive oil, cottonseed oil, coconut oil, palm oil; peanut is reported to contain it in larger amount. It will be noticed that this factor is found chiefly in the more expensive fats.

While green-leaf vegetables contain the fat-soluble factor, root vegetables are deficient in it; war edema has been frequently reported under circumstances in which root vegetables have formed a large proportion of the diet.

3. Antiscorbutic factor: This vitamin is found in fresh vegetable tissues and (to a much less extent) in fresh animal tissues. Its richest

¹⁶ Lancet, 1919, cxcvii, 28.

sources are such vegetables as cabbages, swedes, turnips, lettuces, watercress, and such fruits as lemons, oranges, raspberries, tomatoes. Inferior in value are potatoes, carrots, French beans, scarlet runners, beetroots, mangolds and also (contrary to popular belief) lime-juice. Potatoes, also classed among the less valuable vegetables as regards antiscorbutic value, are probably responsible for the prevention of scurvy in northern countries during the winter owing to the large quantities which are regularly consumed. Milk and meat possess a definite but low antiscorbutic value. This vitamin suffers destruction when the fresh foodstuffs containing it are subjected to heat, drying or other methods of preservation.

All dry foodstuffs are deficient in antiscorbutic properties; such are cereals, pulses, dried vegetables and dried milk. Tinned vegetables and tinned meat are also deficient in antiscorbutic principle. In case of tinned fruits the acidity of the fruit increases the stability of the vitamin, and prevents to some extent the destruction which would otherwise occur during the sterilization by heat and the subsequent storage

The British Committee also presents the following table showing the distribution of the accessory factors in the commoner foods:

DISTRIBUTION OF THE THREE ACCESSORY FACTORS IN THE COMMONER FOODSTUFFS.

Classes of foodstuff.	Fat-soluble A or antirachitic factor.	Water-soluble B or antineuritic (antiberiberi) factor.	Antiscorbutic factor.
Fats and oils:			
Butter	+++	0	
Cream	++	0	
Cod-liver oil	+++	0	
Beef fat or suet	++		
Peanut or archis oil	+		
Lard	0		
Olive oil	0		
Cotton-seed oil	0		
Cocoanut oil	0		
Cocoa butter	0		
Linseed oil	0		
Fish oil, whale oil, herring oil, etc.	++		
Hardened fats, animal or vegetable origin	0		
Margarine prepared from animal fat	(See below*)		
Margarine from vegetable fats or lard	0		
Nut butters	+		
Meat, fish, etc.:			
Lean meat (beef, mutton, etc.)	+	+	+
Liver	++	++	+
Kidneys	++	+	
Heart	++	+	
Brain	+	++	
Sweetbreads	+	++	
Fish, white	0	Very slight, if any.	
“ fat (salmon, herring, etc.)	++	“	
“ roe	+	++	
Tinned meats	?	Very slight.	0

* Value in proportion to amount of animal fat contained. V. slight = Very slight.

Milk, cheese, etc.:			
Milk, cows', whole, raw . . .	++	+	+
" " skim . . .	0	+	+
" " dried whole . . .	less than ++	+	less than +
" " boiled " . . .	Undetermined.	+	"
" condensed, sweetened . . .	+	+	
Cheese, whole milk . . .	+		
" skim . . .	0		
Eggs:			
Fresh . . .	++	+++	?0
Dried . . .	++	+++	?0
Cereals, pulses, etc.:			
Wheat, maize, rice, whole grain . . .	+	+	0
" " germ . . .	++	+++	0
" " bran . . .	0	++	0
White wheaten flour, pure corn-flour, polished rice, etc. . .	0	0	0
Custard powder, egg substitutes, prepared from cereal products . . .	0	0	0
Linseed, millet . . .	++	++	0
Dried peas, lentils, etc. . .	....	++	0
Peaflour (kilned) . . .	....	0	0
Soy beans, haricot beans . . .	+	++	0
Germinated pulses or cereals . . .	+	++	++
Vegetables and fruits:			
Cabbage, fresh . . .	++	+	+++
" " cooked . . .	....	+	+
" dried . . .	+	+	V. slight
" canned . . .	....	....	"
Swede, raw expressed juice . . .	....	....	+++
Lettuce . . .	++	+	++
Spinach (dried) . . .	++	+	
Carrots, fresh raw . . .	+	+	+
" dried . . .	Very slight		
Beetroot, raw, expressed juice . . .	....	....	less than +
Potatoes, raw . . .	+	+	
" cooked . . .	....	....	+
Beans, fresh, scarlet runners, raw . . .	....	....	+++
Lemon-juice, fresh . . .	....	!...	+++
" " preserved . . .	....	....	++
Lime-juice, fresh . . .	....	....	+
" " preserved . . .	....	....	V. slight.
Orange-juice, fresh . . .	....	....	+++
Raspberries . . .	....	....	++
Apples . . .	....	....	+
Bananas . . .	+	+	V. slight.
Tomatoes (canned) . . .	....	....	++
Nuts . . .	+	++	
Miscellaneous:			
Yeast, dried . . .	....	+++
" extract and autolyzed . . .	?	+++	0
Meat extract . . .	0	0	0
Malt extract . . .	....	+ in some specimens	
Beer . . .	....	0	0

A possible method of differentiation of the accessory food factors appears in a paper by Zilva¹⁷ who showed that the exposure of treated lemon-juice to ultraviolet rays does not influence its antiscorbutic activity. Similarly, the exposure of autolyzed yeast juice for the same length of time does not impair its antineuritic potency; but butter exposed for eight hours to ultraviolet light undergoes a very

¹⁷ Biochemical Journal, 1919, xiii, 164.

noticeable change, and the fat-soluble A factor in it becomes inactivated. The sterilization, therefore, by the ultraviolet rays may impair its nutritive value for infant feeding and the keeping of butter in the dark is of importance since light, as is well known, may influence it as it does in acting as a contributory factor to rancidity.

Scurvy. Osler's definition of scurvy as "a disorder of metabolism of unknown origin characterized by great debility with anemia and spongy condition of the gums and a tendency to hemorrhages," is known to most medical men. It is a disease which has been known since the earliest times and its clinical picture has changed very little. As in other diseases, it is highly desirable to recognize it in the earliest stages, and Cozzolino¹⁸ calls attention again to the necessity of routine examination of the gums in infants as well as in adults. He reports 8 cases which might have escaped detection except for this routine examination.

Another article dealing with the clinical manifestations of scurvy is that by Comby¹⁹ who noted that among 60 cases of the infantile type there was a painful pseudoparalysis in all but two. In 46 there were ecchymoses of the gums. There were associated signs of rachitis in about half the patients. In the majority of cases he states the symptoms from the scurvy had been ascribed to other causes, a common blunder being the diagnosis of inherited syphilis. He recalls the case of Burekhardt in which an infant of eleven months was considered to have either osteomyelitis or sarcoma of the femur, prompt recovery following, however, when treatment for scurvy was tentatively applied.

Eaton²⁰ refers to a case of scorbutic hematuria occurring in a poorly-nourished child fed on patent foods and on cooked foods, but never on fresh raw foods. Calculus was ruled out in the diagnosis and upon the prescription of fresh raw milk, beef-juice and orange-juice, the hematuria disappeared.

Zilva and Wells²¹ have investigated the teeth in experimental scurvy. A great number of teeth derived from guinea-pigs in various stages of scurvy were examined. They found that even in the mildest cases there were well-defined microscopic changes in the dental structure. In advanced cases the teeth were useless, inasmuch as they had been loosened by the gradual absorption of the cement membrane of the alveolar sockets. It is probable that periostitic pain accompanied this condition as in the case of human patients. The condition in the young and in the old guinea-pigs was the same and the changes in the teeth brought about by a diet deficient in antiscorbutics was also demonstrated in the monkey.

Antiscorbutics. Most of the recent observations on scurvy have had to do with the relation of certain food factors spoken of briefly as antiscorbutics in the etiology and prevention of the disease. We have

¹⁸ *Pediatrics*, Naples, July, 1919, xxvii, 7; Abstract, *Journal of the American Medical Association*, 1919, lxiii, 799.

¹⁹ *Archives de Médecine des Enfants*, Paris, Abstract, *Journal of the American Medical Association*, 1919, lxii, 1875.

²⁰ *Journal of the American Medical Association*, July 26, 1919.

²¹ *Proceedings of Royal Society, London*, 1919, B. xc, 505.

reviewed (p. 238) the report of the British Committee on the distribution of the antiscorbutic vitamins among various foodstuffs. The Committee also called attention to the value of germinated seeds as antiscorbutics if fresh vegetables or fruits are scarce or absent. These can be prepared by moistening any available seeds (wheat, barley, rye, peas, beans, lentils) and allowing them to germinate. It is necessary, or course, that these should be in the natural whole condition, not milled or split. The seeds should be soaked in water for twenty-four hours, and kept moist with access of air for one to three days, by which time they will have sprouted. This sprouted material possesses an antiscorbutic value equal to that of many fresh vegetables, and should be cooked in the ordinary way for as short a time as possible.

In case of shortage, it should be remembered that salads are of more value than cooked vegetables. The extent to which the antiscorbutic factor is destroyed during cooking depends chiefly upon the time employed. When supplies are limited, vegetables should be cooked separately and for as short a time as possible; they should not be cooked for long periods with meat in soups or stews.

Preserved foods, with a few exceptions, may be regarded as devoid of the antiscorbutic principle. Lemon-juice retains some value in this respect; canned tomatoes (and presumably other tinned acid fruits) have also antiscorbutic value. *Canned vegetables are useless for prevention of scurvy, as also are dried vegetables.*

Prescott²² reported that in the Mesopotamia campaign the occurrence of scurvy was noted in some places as the result of the constant and exclusive use of dried foods. This observation is of importance in connection with the recent development of "dehydrated vegetables"—a process which gives promise of possibilities in the conservation of crops and economy in transportation, etc. It is unlikely, however, that dehydrated foods would form an excess in diet under ordinary conditions of life except for very limited periods.

Infantile scurvy must be considered separately, as many foodstuffs are unsuited to infants or young children. To avert danger, all artificially nourished infants should receive an extra antiscorbutic. Cows' milk, even when raw, is not rich in the antiscorbutic vitamin; when heated, dried or preserved, the amount contained is still further reduced.

Barnes and Hume²³ conducted a series of experiments on guinea-pigs and monkeys to determine the antiscorbutic value of cows' milk, fresh, heated and dried, and came to these conclusions:

1. Cows' milk, even when fresh, was found to be a foodstuff comparatively poor in antiscorbutic properties, and large daily rations, 100 to 150 c.c. daily for guinea-pigs and 125 to 175 c.c. daily for monkeys, were needed to protect these animals from scurvy when upon a diet otherwise devoid of antiscorbutic material. Dried milk was found inferior to raw milk in this respect. Even with material of quite recent manufacture we were unable to protect guinea-pigs from scurvy with any amounts that it was found possible to administer. In case

²² American Journal of Physiology, 1919, xlix, 573.

²³ Lancet, 1919, cxvii, 323.

of monkeys the minimum protective dose was found to be approximately from 250 to 300 c.c. daily; in other words, about half the original antiscorbutic value of the fresh milk had been destroyed in the process of drying. "Scalded" milk was found distinctly superior to dried milk.

2. These facts form a strong argument for the desirability of adding an extra antiscorbutic to the diet of infants nourished on dried milk. The most suitable substances for this purpose are raw orange-juice, raw swede-juice (Chick and Rhodes, 1918), or juice of tomatoes, raw or canned (Hess and Unger, 1919). Grape-juice and carrot-juice are also useful but less valuable, as being inferior in potency, correspondingly larger doses are required. Potatoes, cooked and mashed, can be employed in cases where starchy foods are not considered unsuitable (Hess and Fish, 1914).

3. Some evidence was obtained showing that winter milk is inferior to summer milk in antiscorbutic properties, corresponding to the differences in cows' diet at these different seasons. In this connection the suggestion is made that the value of winter milk in this respect might be raised if swedes were employed for winter feeding in place of mangolds, when possible. In the investigation of Chick and Rhodes alluded to above, the raw juice of beetroot, to which plant the mangold is nearly related botanically, was found to be much inferior to that of swede as an antiscorbutic.

4. No significant difference was detected in the growth-promoting properties of raw and dried milk respectively, and this was true with both guinea-pigs and monkeys. In both cases growth declined with the onset of scurvy symptoms, until this occurred the growth made upon diets containing dried milk was equal to that obtaining when equal rations of fresh milk were substituted.

These observations are interesting in connection with those of Hess and his co-workers who reported several years ago outbreaks of scurvy among infants fed for several months on cows' milk pasteurized at a temperature as low as 63° C. for thirty minutes which indicated at that time a poverty of heated milks in the antiscorbutic vitamin. In a recent observation, Hess and Unger²⁴ reported that an infant requires fully one pint of fresh raw milk daily to protect it from this disorder. They state that babies fed on pasteurized milk should receive an antiscorbutic from the time they are a few weeks of age, as there is no reason for allowing the negative balance of "vitamin" to continue for a longer period. A small amount of orange-juice will answer the purpose, and is potent for a period after alkalization. Its value does not reside in its laxative properties, or in its salt content, as "artificial orange-juice" has practically no therapeutic effect. If orange-juice is filtered, boiled and rendered faintly alkaline it may be given intravenously without causing any slightly untoward reaction. In this way a very prompt cure can be effected.

From a pathogenic point of view, a result obtained by this route is of interest as demonstrating that scurvy can be counteracted by a

²⁴ American Journal of Diseases of Children, 1919, xvii, 221.

therapy acting quite apart from the alimentary tract. Diuresis and catharsis do not play an important role in the cure of scurvy, as they may be stimulated to a high degree without alleviating the symptoms. This fact argues against regarding this disorder as essentially toxic in nature. It was found also that giving an antiseptic (sodium benzoate) was without effect. Dehydrated vegetables were ineffective in two instances studied by Hess and Unger in which an equivalent amount of fresh vegetables brought about a cure. They do not infer from this result that dehydration necessarily destroys this "vitamin." In this connection too much attention has been paid to the degree of heating process, and too little to the more important factors—the age of the vegetables, their freshness previous to dehydration, their manner of preservation, etc. For almost a year strained canned tomatoes have been given by Hess and Unger, in place of orange-juice, to a large number of infants. This substitute has been found a very effective antiscorbutic, and is well borne by babies a few weeks of age. It has the advantage of low cost and availability, and therefore is of particular value for the infants of the poor.

If babies are breast-fed it is important that the pregnant and nursing mother should receive an adequate supply of antiscorbutic food in her diet. The popular belief that green vegetables are harmful in such cases is often without foundation. Infantile scurvy is not unknown in breast-fed children.

The antiscorbutic and growth-promoting value of canned vegetables was investigated experimentally during the past year by Campbell and Chick²⁵ who conclude as follows:

1. In this process of canning vegetables the greater part of the original antiscorbutic value of the raw vegetable is destroyed. In the case of runner bean pods the loss is estimated at about 90 per cent. of the original value; in the case of cabbage at about 70 per cent. of the original value. The process of canning cabbage included heating in water for about one hour at 90° to 100° C., and for beans the process was repeated on the day following.

2. This loss is primarily due to the destruction of antiscorbutic material occurring during the heating involved in the process of canning. A further loss may be expected to take place during the period of storage. The canned cabbage was examined two weeks after preparation and the canned beans three months after.

3. In the case of green-leaf vegetables which possess, in addition to the antiscorbutic vitamin, the "fat-soluble" growth promoting accessory factor, the latter substance is also lacking in the canned material unless the liquor be also taken.

4. The value of canned vegetables as regard antiscorbutic and growth-promoting properties must be regarded as negligible.

The *value of lemon-juice* as an antiscorbutic has recently been compared experimentally by Chick, Hume and Skelton²⁶ with the juice of fresh limes. Equal volumes of the juices possess an unequal potency,

²⁵ *Lancet*, 1919, cxcvii, 320.

²⁶ *Ibid.*, 1918, xxii, 73.

the lemon-juice being about four times more potent than the lime-juice. In one experiment severe scurvy developed in a monkey in a diet containing 5 c.c. of fresh lime-juice daily and was cured by an equal ration of fresh lemon-juice. Preserved lime-juice was found to be useless as a preventive, and although the experiments with preserved lemon-juice are still in progress, the promise of results are better. These writers recall the history of two Arctic expeditions, one in which lemon-juice was supplied with the absence of scurvy during the first two years of great difficulty and privation; the second supplied with lime-juice, suffered severely from scurvy at the end of the first winter spent in the Arctic regions.

In connection with the use of lemon-juice in the treatment of scurvy, it is important to recall the observations of Harden, Zilva and Still, reviewed in last year's issue of *PROGRESSIVE MEDICINE*, which show that it is possible to concentrate the antiscorbutic principle in lemon-juice by the removal of the free citric and other acids. If care is exerted not to elevate the temperature too much, the preparation can be concentrated in bulk to any desired volume and even evaporated down almost to dryness without losing its potency as an antiscorbutic. They report 4 cases with prompt response to the intensive treatment which such concentration of the lemon-juice allows. In this way it is possible, for example, to give quantities equivalent to the juice of twelve lemons daily without gastro-intestinal disturbance.

Harden and Robison²⁷ have shown with regard to concentrated orange-juice that the antiscorbutic factor is retained by evaporation at 40° C. under reduced pressure and it retains this value when kept in a dry atmosphere of room temperature during a period of six months. These same observers have found by the use of this modern method of concentration without the application of high temperature that it is possible to prepare fruit jellies which are not devoid of antiscorbutic potency.

Givens and McCluggage²⁸ have substantiated further that it is possible to preserve and concentrate orange-juice if the process of drying is not conducted at an unduly high temperature and if the duration of drying is short. If the orange-juice is submitted to a temperature of from 55° to 60° C. for forty hours or more a part of the antiscorbutic vitamin is destroyed. These same observers²⁹ have shown that if the raw fresh tomato, which is a very efficient antiscorbutic, is dried in a blast of air at either a low temperature (35° to 40° C.) or a high temperature (55° to 60° C.) retain a significant amount of their antiscorbutic potency. A daily supplement of 1 gram of dried, raw tomatoes protected guinea-pigs from experimental scurvy. Therefore the tomato may be considered a valuable addition to the dietary in which it is desired to increase the antiscorbutic principle.

Pellagra. INCIDENCE. Some interesting data with regard to the incidence of pellagra may be found in a recent report of the experience

²⁷ *Journal Royal Army Medical Corps*, January, 1919.

²⁸ *American Journal of Diseases of Children*, July, 1919, xviii, 30.

²⁹ Abstract, *Journal of the American Medical Association*, March 8, 1919.

of the Metropolitan Life Insurance Company.³⁰ The statistics given are of importance because they cover a large part of the region of pellagra incidence in the United States, and second, because the figures refer to the wage-earning group of the population among whom pellagra is more prevalent than in populations generally. The following table gives an idea of the geographic distribution of pellagra in the several districts of the South and Southwest and shows clearly that the death-rate is greater among the colored:

MORTALITY FROM PELLAGRA IN SELECTED SOUTHERN DISTRICTS
(CLASSIFIED BY COLOR. YEARS 1914, 1915 AND 1916
COMBINED. RATES PER 100,000 EXPOSED).

Experience of Metropolitan Life Insurance Company. Industrial Department.

Area and district.	Rate per 100,000.	
	White.	Colored.
Entire Metropolitan Experience	3.3	17.9
Southern districts combined	27.5	57.6
Birmingham, Ala.	16.0	28.7
Little Rock, Ark.	16.5	63.1
Atlanta, Ga.	68.8	106.0
Augusta, Ga.	67.7	101.0
Columbus, Ga.	176.6	293.9
Macon, Ga.	102.3	108.5
Savannah, Ga.	33.4	70.4
New Orleans, La.	5.4	19.1
Poplar Bluff, Mo.	11.4	8.7
Charlotte, N. C.	81.4	102.4
Greensboro, N. C.	53.1	98.1
Raleigh, N. C.	35.1	127.3
Columbia, S. C.	167.5	167.9
Spartanburg, S. C.	83.8	117.8
Chattanooga, Tenn.	51.5	57.5
Jackson, Tenn.	29.5	61.2
Knoxville, Tenn.	68.8	56.8
Memphis, Tenn.	22.3	109.3
Nashville, Tenn.	41.4	40.3
Richmond, Va.	24.2	19.6
Roanoke, Va.	56.2	52.3

Another table which, however, we will not reproduce here, shows the mortality from pellagra, classified by age, color and sex. Examination of the table shows that there is a constantly rising death-rate with advancing age. The disease has its lowest incidence as a cause of death in the ages of childhood. In fact, the number of deaths of white children under fifteen is negligible; colored children show a larger number of cases. After age fifteen, the rates increase regularly with age until the age period fifty-five to sixty-four years is reached. From this point onward the rates fall slightly among white lives but continue to increase among the colored.

The death-rate among colored persons is higher than among white persons. This is true at every age period and for both sexes. The rate for females is higher than for males both among the white and among the colored. This is found at virtually every age period. Since

³⁰ Mortality Statistics of Insured Wage-earners and Their Families, 1919, 249.

no such difference between the rate of the sexes has been observed in a number of other countries where the disease is prevalent, it will be interesting to learn what factors may be operative in this country to account for the predominance of pellagra among females.

The occurrence of *pellagra among Turkish prisoners* has been the subject of an interesting contribution by the Military Committee at Alexandria. The conclusions of this committee have been summed up tersely in a *Lancet* editorial³¹ as follows:

"The disease was true pellagra and the patients were generally pellagrous before capture. The great majority of the cases that were systematically questioned stated that they had similar symptoms before capture, while among those examined shortly after they were made prisoners many were found suffering from the fully developed disease. For example, in one batch of 1300 prisoners seen on their arrival direct from the front, 18 per cent. had the malady fully developed. There was no evidence of case-to-case infection, and none pointing to location or local conditions having had anything to do with the causation or spread of the disease. The camps at Kantara left little to be desired as regards their situation and hygienic condition. As regards diet, judged by existing standard, the food issued to both non-labor and labor prisoners provided an ample margin over the requirements of healthy men and gave a suitable balance of proximate food principles. Any increase in the disease has not been due to other general conditions than those unavoidable for prisoners in monotonous confinement in an alien, hot and arid country, with no stimulus to check the inevitable decline in their physiological resistance. Pellagra as a primary or immediate cause of death played an insignificant part in the series of cases that were examined. As a contributory cause its influence was shared by other debilitating diseases, of which chronic dysentery was the worst. After thorough investigation by the various experts, no evidence was found as to the etiological relationship of the disease to bacteria, protozoa, or to blood conditions. With regard to food, the committee found so constant an association between the biological protein value of diet and the occurrence of pellagra that they considered that the lack of sufficient biological value of protein stands in etiological relationship to pellagra, certainly as an exciting factor, and possibly as the determining factor. The report states that the deficiency in biological value of protein may be: (1) absolute, as determined by the standard for normal persons, or (2) relative, as determined by individualistic correlation between food assimilation and energy expenditure, and thus modified by ill health and idiosyncrasy. A large proportion of the cases showed helminthic and flagellate infections of the intestines. These cannot be regarded as causal factors, but merely contributory to digestive disturbance and malnutrition. Pellagra produces loss of resistance to the invasion of bacterial and protozoal disease, and this is, therefore, a contributory factor to a high rate of mortality. The recommendations made by the committee were: (1) In view of the pellagra

³¹ *Lancet*, 1919, cxcvii, 490.

admission rates having remained approximately constant in non-labor camps during the last two months, and having diminished so markedly in labor camps in the present month (December), it is considered that the full authorized diets are adequate, and it is not necessary at present to introduce any cardinal change. (2) Full variety should be given under the alternatives of the existing ration scales, and close supervision should be exercised over preparation and cooking of food, with special regard to pulses in both respects. (3) Any increase in pellagra should be met by an increase in animal protein; the occurrence of edema should be met by an increase in fat. It may be added that over 2000 German, Austrian, and Bulgarian prisoners of war occupied a compound immediately adjoining that occupied by 6000 Ottoman prisoners. Both compounds had been living under precisely the same conditions, but not a single case developed among the Germans, Austrians, or Bulgars, whereas there were some 300 cases among the Turks in the adjoining compound. No case of pellagra occurred among the British troops. The Turkish prisoners for long periods prior to capture had been on rations considerably below the value of those they received after arrival at Kantara, and also below the standard of minimal needs, and had been subjected to great physical strain and privations."

It may be well to recall that there are three principal theories concerning the etiology of pellagra: (1) the deficiency theory in which it is supposed that the disease is due to the absence of some vitamin, (2) the maize theory in which corn is supposed either to contain some toxic substance or to be deficient in some necessary substance, (3) the microbic theory in which the disease is attributed to some organism or organisms as yet unknown. The observations among Turkish prisoners would seem to lend weight to the food deficiency theory. Zilocchi's²² observations in a pellagra zone in Italy and in adjacent regions where pellagra is absent sustains the view that pellagra is the result of a too one-sided diet, not supplying enough calories, while the fact that it is usually poorly cooked favors gastro-intestinal derangement. The lack of proper nourishment in time induces a constitutional substandard condition, and the vegetative system suffers with all that this implies for the nervous and digestive systems and the skin. There is also secondary action from retained toxic waste.

Siler, Garrison and MacNeal, of the Thompson Pellagra Commission,²³ however, continue to maintain the infection theory regarding the spread and outbreak of pellagra. Their observation indicated that since 1914 practically all the new cases of pellagra in the community which they studied developed while the person was residing in the same house with or next door to a pellagrin in the active stage of the disease, or within six months after such exposure. It was further noted that following the installation of a proper sewage system the spread of the disease was almost wholly arrested, all of which tends to lend support to the infection theory regarding the spread and outbreak of pellagra.

Since its recognition in Alabama, in 1906, pellagra has interested

²² Abstract, *Journal of the American Medical Association*, 1919, lxxiii, 871.

²³ *Southern Medical Journal*, December, 1918.

physicians in the United States where it has been found widely distributed, especially in the Southern States. That it may occur in the Northern States is evidenced by the report of Schwartz²⁴ who during the past year reported a typical case occurring in Pittsburgh. The clinical notes supplemented by necropsy findings are of practical importance and I am quoting the case in full.

C. P., male, white, aged thirty-three years, married, street-car motorman, was born and reared on a farm in Potter County, removing to Oakmont, a small town near Pittsburgh, twelve years ago.

Family and previous medical histories were negative. No history of venereal disease was obtainable. Wife is healthy, miscarried first pregnancy, and second pregnancy came to full term, child living and well.

History of Present Illness: Early in 1907 patient felt out of sorts, had vertigo, pain in head, complained of great weakness, had insomnia and was very despondent. A few weeks later he developed anorexia, stomatitis epigastric pain, diarrhea, vomiting and a mild jaundice. Emaciation was rapid and severe, and patient developed delusions of persecution and contemplated suicide.

At this time he had severe pains in spine radiating down arms and legs, and a few days later there developed, suddenly, a rose-red discoloration on the back of hands and wrists, which were swollen and burned. This condition lasted two or three weeks and was followed by desquamation, which left the involved areas roughened and slightly pigmented.

With the advent of summer, improvement began and his convalescence was uninterrupted, and by September 1 he had gained 60 pounds in weight and was able to return to work.

Each succeeding year until 1914 he had practically a repetition of the above described syndrome, relapsing, with increasing severity, from summer to summer and improving or disappearing during the winter.

From 1914 until November, 1916, he was apparently free from the disease, enjoyed good health and worked every day.

In November, 1916, the disease again relapsed, with increasing severity. The jaundice was general and intense, lasting for three months; patient had severe stomatitis, diarrhea and vomiting and lost 80 pounds in weight. With the advent of summer improvement began and was uninterrupted until August 1, 1917, when the present relapse developed, and two weeks later he developed, overnight, practically continuous bullæ over the dorsal and palmar surfaces of hands and fingers. The bullæ did not involve the lower one-third of the forearms except a cuff, one inch wide, at upper border or line of demarcation.

Physical Examination: Patient is emaciated and stuporous and in a typhoid state. The tongue is intensely swollen, red and glazed, with numerous tiny pearl-white spots which extend to the entire mucous membrane of the mouth and the soft and hard palate, probably thrush.

²⁴ Pennsylvania Medical Journal, 1919, xxii, 422.

The mouth is very septic, sordes are present and the breath is very fetid. The skin over the face and neck is dark brown, slightly atrophic and desquamating; over the elbows, around the anus extending over the raphe and involving the posterior surface of the scrotum the skin is pigmented and leathery, with coarse exfoliation of the epidermis.

The hands and fingers on the dorsal and palmar surfaces are covered with pustules and indolent ulcers; the wrists are pigmented and atrophic and at the junction of the lower and middle third of the forearm an indolent ulcer, 1 inch wide, surrounds the arms. The plantar surface of the great toes shows slight keratosis. Numerous petechiæ are present over the abdomen, which is distended and tympanitic.

Nervous Symptoms: Pupils are dilated, but otherwise normal; reflexes are exaggerated. Patient complains of a distressing sensation of burning in the extremities and the stomach. Vertigo has been very troublesome throughout the illness, and he has had delusions of persecution and melancholia symptoms during each relapse.

The urine was negative.

The blood examination showed a moderate anemia, 80 per cent. hemoglobin and 4,100,000 red cells. The culture was negative, and the Wassermann reaction was positive.

The temperature ranged between 97° and 101° F., with morning remissions and evening exacerbations.

Death occurred September 9.

Necropsy, eighteen hours after death, by Drs. Klotz and Richey, revealed dermatosis of hands, forearms, elbows, perineum and scrotum; superficial ulceration of skin; atrophy of skin; acute ulcerative colitis, proctitis, stomatitis; chronic gastritis; dilatation of stomach; cloudy swelling of the liver and kidneys; acute fibrinous peritonitis (localized); hypostatic congestion of lung; edema of lung; acute m. p. bronchitis; fatty intimal streaking of aorta; accessory spleen. The case was one of acute pellagra in which the cutaneous and intestinal manifestations were typical.

In discussing the diet of the patient, Schwartz stated that he had gone into the matter very thoroughly and found that he did not eat any of the corn preparations and scarcely ever, with the exception of game, had fresh meats, having mostly salt meats. Otherwise the diet was a normal one of farm life. He had moved to a small town shortly before his death and had never been out of the State.

Stewart³⁶ is of the opinion that pellagra is in some way related to thyroid disturbance. He reports 5 cases treated successfully with thyroid extract or sodium cacodylate, making 28 patients in all who have been treated by this plan.

Beriberi. Our present conception of beriberi is that of a disease due to a deficiency in the diet of a definite substance (antineuritic vitamin) which is essential in normal nutrition. In the elucidation of the many questions connected with this substance, animal experimentation has been of the first importance, thus Eijkman's discovery

³⁶ Southern Medical Journal, 1919, vii, 238.

that polyneuritis in fowls could be induced by an exclusive diet of polished rice was the first step which materially contributed to our present conception of the etiology of beriberi and its prevention. During the past year, Voegtlin and Lake²⁸ have advanced our knowledge by producing experimental polyneuritis in the higher forms of animals represented by the mammals. The principal results which they obtained are as follows:

I. Polyneuritis has been produced in cats and dogs as the result of an exclusive dietary of lean beef which was heated for three hours at 120° C. in the presence of alkali (sodium carbonate). Proof of this statement is furnished by the symptomatology, treatment and pathology of the disease noted, which are essentially those characteristic of beriberi.

1. *Symptoms.* The following symptoms were observed in these animals: Diminution of appetite, constipation, loss of body weight, weakness and sometimes drowsiness, followed by paralytic symptoms, tonic convulsions, spasticity of certain groups of muscles and disturbances of the circulation and respiration.

2. *Treatment.* The oral administration of active preparations of the antineuritic substance of yeast to paralyzed animals is followed promptly by the disappearance of the symptoms, and the continued administration of these preparations prevents the recurrence of the disease.

3. *Pathological Changes.* Certain histopathological changes, especially the changes involving the nervous system, are described. Animals showing severe paralysis exhibit no qualitative changes in the reaction of various nerves to electric stimulation.

II. The disease is due to a deficiency of the diet in antineuritic substance, and not to a deficiency in the other essential dietary components (amino-acids, fat-soluble vitamin, etc.).

III. Exposure of the beef for three hours to a temperature of 120° C., without the previous addition of alkali, does not completely destroy the antineuritic power of this food. It is, therefore, concluded that the ordinary preparation of meat for human consumption does not lessen its food value in this respect.

IV. The various species of animals show a considerable difference in their susceptibility to polyneuritis, as evidenced by the different length of time which is necessary to induce the disease by the same deficient diet. Cats respond to the deficient diet with the greatest regularity and are, therefore, best adapted for physiological studies of the function of the antineuritic substance.

Since nothing of note has appeared during the past year with regard to the clinical manifestations of beriberi we will pass on to the treatment of this disease.

TREATMENT OF BERIBERI. Although the extract of rice polishings has become recognized as one of the most efficient remedies in the treatment of infantile beriberi; it does not, however, markedly improve

²⁸ Public Health Reports, 1919, No. 1, xxxiv, 3.

chronic cases and in addition possesses toxic qualities which make it necessary that it should be administered only under the direct supervision of a physician. Saleeby³⁷ has called attention to the treatment of human beriberi with autolyzed yeast extract, under the use of which, even in large doses, no evidences of poisoning were observed. He recalls the fact that the value of yeast in the treatment of polyneuritis in fowls has been known for some time and that it could be used in large doses without harm. Saleeby describes the method of obtaining autolyzed yeast and summarizes his findings in its use in 40 patients, 5 of which were children below two years of age. The summary of his findings is as follows:

The adults were given from 15 to 40 c.c. three times a day. Children were given from 2 to 4 c.c. every three hours, or six times a day. Larger doses did not seem to give better results. No sign of poisoning was observed.

Only acute and uncomplicated symptoms of beriberi were observed under treatment. Chronic nerve, muscular, or cardiac lesions were actually unaffected.

All acute peripheral symptoms of neuritis were affected quickly. Marked results were noted in less than three days, and a week's treatment seems to give full relief in mild acute cases. Treatment was generally followed up for two weeks at least.

Infantile beriberi symptoms were relieved with comparative rapidity. Edema yielded quickly, and nutrition improved at once.

No special diet was prescribed. Patients were given regular hospital diets in accordance with the state of their digestion.

Children receiving the extract continued to nurse at the mother's breast.

The effect of the autolyzed yeast extract used is similar to that produced by the hydrolyzed extract of rice polishings; it seemed weaker, however.

Rickets. This disease plays a far more important part in ill health than we may be willing to believe. As Mellanby³⁸ points out, if the matter ended with the bony deformities obvious to the eye, it would be had enough, but investigations have demonstrated that such deformities only represent a small part of the cases affected. It is a striking fact that in the west of Ireland, where the death-rate is only 30 per 1000, rickets is an unknown disease, whereas in poor urban districts of England, where rickets is rife, the death-rate in children varies from 100 to 300 per 1000. It is at least suggestive that there may be some relation between rickets and the enormous death-rate of towns even although the disease in itself does not kill.

Investigations directed toward establishing the etiology and the methods of preventing rickets ought to be productive of a greatly reduced infant mortality. The cause of rickets has been the subject of numerous investigations, both with regard to the predisposing and the direct factors. In Glasgow, for example, Miss Ferguson pointed

³⁷ *Philippine Journal of Science*, 1919, xiv, 11.

³⁸ *Lancet*, 1919, cxvii, 407.

out that the factors favorable to the development of rickets were: (1) Insufficient space in houses; (2) confinement in such houses; (3) imperfect parental care. Granting the importance of these predisposing influences, the modern studies of the direct factor have all tended toward placing the cause on some food deficiency. Mellanby reviews some of the earlier dietetic hypotheses and correlates them with our modern conception as follows:

Rickets as a Disease due to Deficiency of Fat. The work of Bland-Sutton on the lion cubs at the Zoölogical Gardens has left its impress on English thought, and, together with the acknowledged efficacious results that follow the treatment of rachitic children, with cod-liver oil and other fats, has brought about a general acceptance of the view that rickets is due to deficient fat in the diet. Mellanby's results and those of other observers make it clear why this view is so commonly held but demonstrate also that the efficacy of fat does not depend on fat *per se*, but rather on the type of fat, and whether it contains an abundance of the antirachitic factor, animal fats being superior to vegetable fats.

Excess of Carbohydrate in the Diet. When a diet contains excess of carbohydrate it means that it is made up largely of cereals. Now cereals, and more particularly cereals like wheat, rice and oats, which have undergone transformation in the course of manufacturing processes, are most deficient in antirachitic factor. A diet, therefore, of such substances is quite unbalanced and most effective in producing rickets.

Deficiency of Fat and Excess of Carbohydrate. This condition comprises the first two hypotheses; such a combination would most certainly involve a deficiency of antirachitic factor.

Deficiency of Calcium Salts in the Diet. It has been shown that an abundance of calcium in the diet, either in the form found in separated milk or in calcium phosphate, will not prevent rickets when the diet is deficient in antirachitic factor. Similarly, it has been found by some workers that a diet deficient only in calcium salts, but otherwise adequate, will not produce rickets. It is, however, more than probable that a deficient calcium intake associated with deficient antirachitic factor will bring about a more acute production of rickets, and must always be an adjuvant factor to be considered in the etiology of rickets.

In his experimental work, Mellanby pursued this method. Animals were placed upon a diet which was known to produce rickets. To this diet were added various substances, and the effect in the development of the disease noted. He found that of the three factors known, fat-soluble A, water-soluble B and antiscorbutic, two of these can be at once excluded. Yeast has no preventive influence on the development of the disease, and, in consequence, water-soluble B cannot be considered as of importance. Again, orange-juice, sufficient to exclude any possibility of scurvy when considered with the rest of the diet, did not inhibit the disease, and this therefore allows the exclusion of the antiscorbutic factor. On the other hand, the antirachitic sub-

stances for the most part have been found, so far as the rickets experiments have gone, to be similar to those of McCollum, Osborne, Mendel and others, in which, according to the experiments on growth, fat-soluble A is present. It therefore seems probable that the cause of rickets is a diminished intake of an antirachitic factor which is either fat-soluble A or has a somewhat similar distribution to fat soluble A.

It has been demonstrated in Mellanby's work that large and rapidly growing puppies require more antirachitic factor to prevent the development of rickets. If, therefore, fat-soluble A and the antirachitic factor are identical, the presumption is that the function of fat-soluble A in the diet of puppies is not so much to ensure growth as to promote correct growth; in other words, to keep the growth straight; and the greater the amount of growth in any period the greater is the amount of fat-soluble A necessary to keep it along normal lines. If this view is correct, then it can hardly be claimed that fat-soluble A is in any different category from the point of view of growth than the anti-scorbutic factor, for, even in the absence of this latter, the rate of growth diminishes and there is often rapid loss of weight.

One of the difficulties involved in considering the antirachitic factor and fat-soluble A as identical is the part which meat and meat extracts play in the development of rickets. Just as meat has a stimulating action on the growth of puppies far beyond its fat-soluble A content, so also it appears now that the antirachitic action of meat is in a greater measure than any fat-soluble A it is reputed to contain. Either we must recognize that meat contains more fat-soluble A than the rat-feeding experiments have led us to believe or we must endeavor to find another explanation of the action of meat in rickets. It seems to Mellanby that another explanation is possible. It is known that meat has one action on metabolism, which is more strongly developed than in any other foodstuff. This is its specific dynamic action or power to stimulate the total chemical exchanges taking place in the body. In having this stimulating action it will increase the effectiveness of any fat-soluble A in the diet, and will tend to prevent the storing up and deposition of this substance in the subcutaneous and other tissues. Again, any fat-soluble A in the tissues will be more readily mobilized under the stimulating influence of the metabolizing meat. It is probable that the antirachitic action of meat may therefore be due more to its making the fires burn more brightly, and thereby increasing the effectiveness of any fat-soluble A present in the body rather than to the fat-soluble A it possesses in itself. If this explanation of the action of meat be true, then it is still possible to regard fat-soluble A and the antirachitic factor as identical.

Another difficulty, according to Mellanby, which is probably of less importance than the two foregoing, is the widely different action of the vegetable fats as regards the development of rickets. In the growth experiments of previous workers, all the vegetable fats are described as deficient in fat-soluble A, and the impression is received that there is but little difference between them. On the other hand their anti-rachitic influence varies considerably, being obviously present in

arachis and olive oils and absent in linseed and babassu oils. Other vegetable oils, like cocoanut and cottonseed, occupy an intermediate position. If the antirachitic factor is fat-soluble A, then it must be accepted that the type of experiment described in this work is a more delicate test for fat-soluble A than previous work involving the growth of rats.

Mellanby calls attention to the danger of applying laboratory results to a clinical condition. His work appears to justify, however, the following statement that the foodstuffs of an infant ought to contain a maximum amount of antirachitic factor. Furthermore, since the dietetic problem is one of balance, foodstuffs which contain no antirachitic factor cannot be considered as neutral, but as positively rickets-producing, for the more of them that are eaten the greater is the necessity for foods containing the factor. Since there is a limit to what a child can eat, the inference is obvious. It is probable that bread is the worst offender, and to allow bread to form too large a part of an infant's dietary seems to me to be courting disaster. The same statement may apply to other cereals, but this has not been worked out to any extent.

Another point of importance is the type and amount of fat eaten by children. Since the above remark as to the limited amount of food a child can eat applies with even greater force to fat, it is necessary to give children the best fat from the point of view under consideration. They should, therefore, not be given vegetable margarines or any other vegetable fat. The natural fat for a child is the fat of milk, and to give it a vegetable fat not only limits the amount of butter it can eat even if procurable, but also weighs down the diet in the rachitic direction. If additional fat is given to that normally eaten, then cod-liver oil is the best.

Undoubtedly milk ought to remain the staple article of diet not only until weaning, but for some years after this time. Milk is undoubtedly better than the corresponding amount of butter. Under normal circumstances the child would then be assured of a good supply of antirachitic factor. Not, however, under all circumstances is this certain, for the work of McCollum, Simmonds, and Pitz has shown that before an abundance of fat-soluble A appears in the milk the mother must have a good supply of this substance in her food. This means that the animal's power of synthesizing these accessory food factors is small or absent. Grass is a good source of fat-soluble A for the cow, and a well-fed cow, from this point of view, will give good milk. The mother drinks this milk, and the accessory food factors are passed on to her mammary glands, thereby allowing the breast-fed child to get an adequate supply.

The problem therefore reverts largely to the feeding of the cow, and it is probable that the cow fed in the stall largely on vegetable oil-cakes will give a milk deficient in accessory food factors. If, therefore, a nursing mother's diet is deficient in the antirachitic factor, it is easy to understand how the breast-fed child develops rickets, for it is probable that the same argument applies even if it should subsequently

prove that the antirachitic factor and fat-soluble A are not identical. Hess and Unger have recently shown that the diet of the negro women in New York, whose breast-fed children are nearly always rachitic, is very often deficient in fat, the amount of milk they drink being small. These suggestions may also explain why rickets develops more commonly in the winter months, when the cows' diet is more artificial.

As for the action of other foodstuffs, it has been pointed out that meat has an antirachitic effect to some extent and even in small quantities (10 grams a day to a puppy) will render a slightly rachitic diet safe, probably by making the antirachitic factor in the diet more effective. Vegetable juices seemed also to have some inhibitory action on the development of rickets.

Hess and Unger³⁹ conclude from their studies that the unravelling of the etiology of rickets is an exceedingly complex problem. They state that it should not be lost sight of that there is a prenatal factor involved. The fact that the negro infant, living side by side with the white in the larger cities and obtaining milk from the same source, develops rickets so frequently and so markedly, indicates that there are important influences to be reckoned with in addition to the food. In considering the vitamin origin of this disorder, their study shows that the fat-soluble vitamin is not the controlling influence; that infants develop rickets while receiving a full amount of this principle, and that they do not manifest signs, although deprived of this vitamin for many months, at the most vulnerable period of their life. Hess and Unger find it impossible to interpret the contrary conclusion to which Mellanby came as the result of his pioneer experiments on dogs, or to accept the term "fat-soluble vitamin" as synonymous with "antirachitic factor," as Hopkins and Chick have done. It must be perfectly obvious to the reader that there is a need for harmonizing animal study, such as that carried out by Mellanby and others and the clinical studies, such as those of Hess and Unger and others. There is evidently much discrepancy in the observations. In their clinical work, Hess and Unger believe that the danger to infants of a diet deficient in fat-soluble vitamin is slight, provided it includes sufficient calories, and otherwise is complete. They can maintain their health and vigor despite amounts of fat-soluble vitamin so small as rarely to be encountered in times of peace. In spite of the fact, therefore, that this vitamin is not widely distributed in nature a disorder that may be termed "fat-soluble deficiency"—marasmus or xerophthalmia—is hardly to be apprehended from a clinical standpoint.

CLINICAL MANIFESTATIONS. Since the recognition of rickets in its early stages is desirable in order to prevent damage to the organism, Vargas⁴⁰ expatiates on the prodromic symptoms which, when heeded, permit the removal of the causes. This prodromic stage includes the period from the first signs that the child is not thriving normally to the manifest deformity in the skeleton, evident in the skull during the

³⁹ Journal of the American Medical Association, 1920, lxxiii, 217.

⁴⁰ Paris Médical, 1919, ix, 309; Abstract, Journal of the American Medical Association, 1919, lxii, 1797.

first six months of life and in the fifth and sixth ribs in infants from six to twenty months old. The child whimpers when it is moved, the scalp sweats freely, the head is swung from side to side as soon as it touches the pillow and digestion is imperfect. A waxy pallor is one of the earliest symptoms and the hemoglobin percentage is low. The very first sign of rickets is a special constipation. The feces are hard; the rectum is unable to expel the lump and it sticks in the anus until aided by mechanical means. There may be fissure of the anus and prolapse of the rectum. Other signs of rickets soon follow. The constipation may alternate with diarrhea, but in both types of stools the content in calcium salts is above normal. The eruption of the teeth and walking are retarded, proportional to the age at which rickets develops.

In the second stage, according to Vargas, the disease, which commenced with the blood, attacks the blood-producing organs, the bone marrow in particular. The resulting abnormal conditions in the marrow and cartilage make their effects felt in the development of the bone. But other organs are affected likewise, the nervous system, the muscles, skin and mucous membranes, as Vargas describes in detail, defining rickets as a "toxic infantile dystrophy characterized by hemolysis, irritability of the blood-producing system and by osteism." The tendency in time is to a spontaneous recovery, but the damage from it can only be warded off by removing the cause.

Diabetes. SUGAR CONTROL IN THE BODY. In the discussion of the sugar control in the body no phase has been given more attention than that of the relationship existing between the percentage of blood-sugar and urine-sugar and the factor which the so-called "renal permeability," "renal threshold" or "renal leak point" plays. An increasing knowledge points to the fact that while normally the kidney is not permeable to blood-sugar values of from 0.07 per cent. to 0.15 per cent., the threshold may be considerably altered one way or the other in certain abnormal conditions. A higher threshold, for example, in nephritis may result in a hyperglycemia without glycosuria; on the other hand a lower threshold with a normal blood-sugar content or even a hypoglycemia may exist with glycosuria. The following tabulation may clarify our conception of the relationship:

1. Normal glycemia (normal blood-sugar content).
 - (a) Without glycosuria.
 - (b) With glycosuria.
2. Hyperglycemia (abnormally high blood-sugar content).
 - (a) Without glycosuria.
 - (b) With glycosuria.
3. Hypoglycemia (abnormally low blood-sugar content).
 - (a) Without glycosuria.
 - (b) With glycosuria.

Normal Blood-sugar (1a). It is generally stated that normal blood-sugar values vary from 0.07 per cent. to 0.15 per cent., depending upon the diet. It is well to recall that Hamman and Hirschman pointed out in 1917 that in normal persons, after giving 100 grams of

glucose, that the blood-sugar curve reaches its height in about one-half hour and the base line is one or two hours. The blood-sugar was always below 0.15 per cent. In diabetes, the highest figures were obtained in from one to two hours when the fasting level was not reached until three or four hours had elapsed. The blood-sugar level was always above 2 per cent. after taking glucose. The best time to make blood-sugar determination is when the maximum concentration occurs, that is, one-half to two hours after breakfast. If the fasting value is desired, the blood should be taken before breakfast. Williams and Humphreys⁴¹ found the range of blood-sugar practically normal in 60 miscellaneous diseases, chiefly gastro-intestinal and pernicious anemia, and excluding diabetes and nephritis and infections, was from 0.07 to 0.16 per cent., with an average of 0.115 per cent. In a series of 9 cases of carcinoma there was a moderate elevation of blood sugar, 0.12 to 0.16 per cent. In a series of 22 miscellaneous infections, chiefly influenza, pneumonia and streptococcus, the range was from 0.07 to 0.15 per cent., with an average of 0.11 per cent.

What has been said in the previous paragraph refers to normal blood-sugar content without glycosuria as found in health and in certain diseases. The question may be asked whether it is possible to have glycosuria with a normal blood-sugar content (1b). It is experimentally possible, as demonstrated by the injection in animals of phloridzin, which, for want of a better explanation, is said to impair the renal function and increase its permeability for sugar. The lowering of the threshold produces glycosuria. Examples of normal blood-sugar values with glycosuria have been reported at various times in the past as examples of the so-called "renal diabetes," which, however, are better termed renal glycosuria, as they have no relation to true diabetes. Longstroth⁴² reports such a case. The patient presented no symptoms of diabetes and no evidence of abnormal carbohydrate metabolism. As will be explained later on—a decreased blood-sugar content may exist with glycosuria for the same reason—lowered renal threshold.

Hyperglycemia without Glycosuria (2a). That we may have an increase over normal values as given to blood-sugar content without its appearance in the urine is typically illustrated in those instances associated with nephritis. Here the renal threshold is increased. Williams and Humphreys state that in the early stages of nephritis, when the general metabolism of the body is but little disturbed, blood-sugars, as a rule, are normal. In the last stages of nephritis, when the patient is in uremia, the blood-sugar will be found very high, often equaling the severe stages of diabetes. Other important metabolic constituents of the blood will be found correspondingly increased, presenting a picture of complete metabolic failure. A third group of cardiovascular cases, characterized by high blood-pressure and little or no evidence of renal disturbance, usually exhibits blood-sugar levels slightly higher than normal. In severe cases of nephritis, patients may

⁴¹ Archives of Internal Medicine, 1919, xxiii, 537.

⁴² American Journal of the Medical Sciences, 1919, clvii, 201.

excrete small quantities of sugar in the urine, frequently giving rise to the misapprehension that true diabetes exists. In such cases the blood-sugar level is not appreciably influenced by carbohydrate restriction, and these patients should not be subjected to the discomfort of a rigorous diabetic diet. McCay⁴³ states that kidney disease may not present glycosuria even when very marked hyperglycemia is present—up to 36 per cent. Failure in nitrogen metabolism precedes, often by months, the rise in blood-sugar, so that the latter has a rather serious prognostic omen.

Hyperglycemia with glycosuria (2b) is the condition one finds in typical diabetes. Williams and Humphreys studied the blood-sugar level in 127 cases of diabetes, of which 71 were females and 56 males. They found no constant level for the appearance of sugar, and that there was no striking relation between the height of the renal threshold and the duration of the diabetes. It would appear, according to these observers, that the threshold tends to rise with the increasing duration of the disease. Younger diabetics, as a rule, have low or normal thresholds. The threshold rises with advancing years. When the diabetes is mild or quiescent, the point at which the kidneys eliminate sugar is stationary; but when the disease becomes progressive, the threshold tends to rise. Before death, the blood-sugar renal threshold may reach great heights with little or no sugar appearing in the urine. A rising renal threshold for sugar in the face of careful dietary treatment is a serious prognostic sign. A high renal threshold for sugar in mild diabetes under proper dietary regulations usually indicates some complication, such as arterial hypertension. A high renal threshold for sugar may mean a physiological expedient to conserve food material. The authors believe that persistent high blood-sugar levels promote exhaustion and rapid decline of function, and the high threshold is merely a safety measure. In severe diabetes, when extremely low diets are necessary to maintain life, the high threshold is essential to take care of the seriously impaired carbohydrate metabolism. In the treatment of diabetes it is desirable to maintain the blood-sugar level as nearly normal as possible, even though severe restrictions in diet may be necessary for this purpose, notwithstanding the fact that the high threshold will permit of a much more liberal diet without the appearance of sugar in the urine. Williams and Humphrey believe that diabetes should be controlled on the basis of the blood-sugar level rather than by urine tests. A persistent low blood-sugar level may be regarded as an extremely favorable sign. A persistent high blood-sugar level, in spite of undernutrition, usually points to an unfavorable outcome. In their experience, cases which hitherto had been intractable and had shown progressive loss of food tolerance, when the blood-sugar level was disregarded, have been greatly benefited and their tolerance increased by regulating the food intake so as to ensure, when possible, a normal blood-sugar level. While they regard 0.15 per cent. as the

⁴³ Indian Journal of Medical Research, 1919, vi, 485 and 508.

maximum normal digestion blood-sugar level, they believe patients are safer when this level is not higher than 0.13 per cent.

The rise and fall in the blood-sugar following the ingestion of glucose (alimentary hyperglycemia) has been studied by Bailey,⁴⁴ who found a rapid rise and fall to normal within an hour in renal glycosuria and early diabetes; and a prolonged increase in blood-sugar value to two and three hours before falling in diabetes of long standing, nephritis, myxedema and hypopituitarism. The blood volume increases with the development of the hyperglycemia, returning to normal with the blood-sugar. Blood-sugar is equally divided between plasma and corpuscles, and both increase in proportion. The excretion of sugar is uninfluenced by the rate of urinary excretion except in some cases of parenchymatous nephritis.

Hypoglycemia with Glycosuria (3b). Langdon Brown⁴⁵ points out that Sir Archibald Garrod, in 1912, in his Lettsomian lectures, defined a group of these cases: Persistent slight glycosuria in which small quantities of sugar are continually present in the urine, in which variations of diet have little or no effect on the output of glucose, and in some of which the quantity of sugar in the blood has been shown to be rather diminished than increased. To this definition Brown adds that in such cases only 1 per cent. to 2 per cent. of the ingested sugar is excreted. The following is an illustrative case:

A schoolmaster, aged thirty-five years, was referred because sugar was found in the urine just before he was going to be operated upon for varicose veins. He felt quite well except ever since he was twelve years old he had occasional fainting attacks. The amount of sugar in the urine varied between 1 and 2 per cent. On a restricted diet he lost flesh, but the sugar in his urine was unaffected. There was no sign of disease of any ductless glands. Dr. Mackenzie Wallis estimated the blood-sugar and found it was as low as 0.062 per cent.

The preceding type of patient is free from renal disease, and, although it is generally conceded that nephritis tends to increased blood-sugar values, the occurrence of hypoglycemia, glycosuria and obvious renal disease has been found as in the following case which Brown refers to: "I remember sending into Sir Wilmot Herringham's wards an elderly man with chronic interstitial nephritis, glycosuria, and marked retinal changes. The blood-sugar was found to be definitely subnormal, and the retinal changes were regarded by the experts as typically those of nephritis."

The question naturally arises whether it is safe to assume from the hypoglycemia alone that the case will not eventually pass into typical diabetes. Brown relates two cases which, because of their practical importance, bear repetition.

An Intermediate Case. A man, aged thirty-eight years, had sugar discovered in his urine when examined for life insurance in 1912. Further examination showed this sugar to be dextrose. He felt perfectly well and had not been absent from business through illness for

⁴⁴ Archives of Internal Medicine, 1919, xxiii, 455.

⁴⁵ Lancet, 1919, cxcvii, 923.

six years. He could play cricket, swim and cycle without inconvenience. In the three years following his rejection for life insurance his weight increased from 10 stone 9 pounds to 11 stone $4\frac{1}{2}$ pounds. His blood-sugar, in 1914, was only 0.04 per cent., yet he was not a typical example of renal glycosuria, as the amount of sugar in the urine on one occasion rose to 9 per cent., and to some extent he responded to dieting. Toward the end of 1915 he began to lose weight and to have symptoms of neuritis. The blood-sugar had risen to 0.142 per cent. Thus, from being hypoglycemic he became hyperglycemic. This case justifies the attitude in renal glycosuria: That until we know more about it, it is well, as a precautionary measure, not to allow the patient to take carbohydrates freely, lest the mechanism for dealing with their metabolism should be really affected, and therefore capable of further damage by carbohydrate excess. This patient was careful about his diet for a time, but as he felt so well he admitted that he became careless and took carbohydrates freely. He appeared to be passing into the ordinary type of diabetes. Fortunately, he took his case more seriously after this and was more cautious. Relaxation was practised gradually after a time, and at the beginning of 1918 he was taking ordinary diet without glycosuria appearing. Since then, no doubt unduly encouraged by this, he has had occasional returns of sugar on too liberal a diet.

Generally speaking, we can safely allow the patient with hypoglycemia more latitude than the ordinary case. The best indication is his weight. If this falls while the glycosuria persists, even though at a low level, he is being dieted too strictly. He probably cannot be rendered free from sugar by the strictest diet, though his general health will suffer.

A Case Showing that Glycosuria with Hypoglycemia may pass into Typical Diabetes. A man in whom sugar was found accidentally in 1909, when about thirty years of age, came under Brown's care in 1914, when his blood-sugar was found to be 0.089 per cent. But as toward the end of 1915 he was losing flesh and not feeling well, the blood-sugar was again estimated and found to be 0.305 per cent. He was admitted to the hospital, and though his blood-sugar fell to 0.12 per cent., he was only free from glycosuria on one occasion. When he left the hospital his blood-sugar was 0.18 per cent. In spite of careful treatment he continued to waste, with much glycosuria and acetonuria. Early in this year he was again taken into the hospital, and on a repetition of treatment of alimentary rest much better results were obtained than on the previous occasion, and at the present moment his urine is free from sugar and acetone.

RELATION OF THE ENDOCRINE GLANDS TO SUGAR CONTROL. Allen's view that all diabetes is pancreatic in origin has been discussed by Brown,⁴⁶ who gives an interesting resumé of the glycosurias of endocrine origin. He discusses the polyglandular hypothesis of Eppinger, Falta and Rudinger who presuppose that diabetes depends on a loss

⁴⁶ Lancet-Croonian Lectures, May 17, 24, 31 and June 7; also Editorial Discussion, Lancet, 1919, xcvi, 985.

of balance between the various ductless glands. It is now established that pituitary hypersecretion lowers the tolerance for sugar and may produce glycosuria, and Weed, Cushing and Jacobson have shown that the sympathetic nervous system produces glycosuria through stimulation of the pituitary. It is also known that thyroid extract can induce glycosuria, and the occurrence of a lowered tolerance for sugar with occasional glycosuria in Graves's disease is well known, while conversely the increased sugar tolerance in myxedema points in the same direction. Williamson's recent report dealing with the clinical phases of the association of thyroid disturbance and diabetes will be mentioned later. Glycosuria can also be excited by excess of epinephrin and the glycosuria produced by so-called diabetic puncture is believed to be mainly produced through the suprarenals. This form of glycosuria ceases when all the glycogen present in the liver has been mobilized. It may therefore be taken as established that underaction of the pancreas or overaction of the suprarenal, thyroid or pituitary can produce glycosuria, and if the polyglandular theory or loss of balance theory be adopted as the explanation, Brown insists on the part that the sympathetic plays in producing such a loss of balance. He states that it may be taken as established that sympathetic stimulation increases blood-sugar as a defensive measure, and that it causes increased secretion of the suprarenals, thyroid and pituitary, the general effect of sympathetic stimulation being katabolic and mobilization of blood-sugar being a preparation for katabolic action. Vagus stimulation excites pancreatic secretion, and Brown infers that sympathetic stimulation may inhibit the secretion of the pancreas. He sums up his view by stating that the sympathetic, both by increasing the secretion of glands which diminish carbohydrate tolerance and by inhibiting the gland which increases carbohydrate tolerance, would raise sugar above the leak point and so induce glycosuria. He concludes that diabetes is due to a deficiency of the pancreatic amboceptor, which deficiency may be due to structural changes in the pancreas or to inhibitory action of the sympathetic on its internal secretions. This effect may be aggravated by sympathetic stimulation of other endocrine glands, thus further diminishing the power of carbohydrate assimilation.

An interesting paper dealing with the *clinical importance of a knowledge of the relationship between the thyroid and diabetes* and glycosuria is that by Williamson,⁴⁷ who records briefly a number of case records. For example:

Mrs. A. H., aged forty-seven years. Seven years before she came under observation she had suffered from a very severe mental shock. Her husband's hand was torn off in an accident. The patient was greatly shocked, and the mental distress was very soon followed by symptoms of Graves's disease. For some time these were severe; then she improved slowly; but about six years after the shock, thirst and symptoms of diabetes were noted, the symptoms of Graves's disease having persisted.

⁴⁷ *Lancet*, 1919, cxcvi, 425.

When admitted into the hospital under Williamson's care, definite symptoms of Graves's disease could still be detected, though they were not very marked (exophthalmos, tachycardia, pulse 120 to 180, thyroid slightly enlarged, and fine tremor of hands). Symptoms of diabetes mellitus of medium severity were also detected. She was cared for in the hospital for three months and was treated for diabetes, which was the prominent affection. The sugar in the urine was estimated daily. The daily amount of urine during this period varied from 80 to 140 ounces, but sometimes it was more than the latter figure; sp. gr. 1030 to 1040; sugar, 18 to 30 grains to the ounce (about 4 to 6.5 per cent.); total amount of sugar in twenty-four hours, 1500 to 2000 grains. In course of time the urine gave a deep reaction with ferric chloride for diacetic acid; then albumin was detected in the urine and finally casts. Death occurred from a sudden attack of hemiplegia.

Williamson believes that the occasional development of diabetes after Graves's disease and the frequent occurrence of temporary or intermittent glycosuria in this disease are facts which should be considered in the treatment. It is advisable in the treatment of all cases of Graves's disease to discontinue the addition of sugar to food and drinks and also to avoid foods and drinks which contain much sugar. These precautions are especially desirable and sugar and sweet food should be cut off entirely if glycosuria, temporary or intermittent, has ever been detected, and in definite diabetes associated with or following Graves's disease the diet suitable for the form of diabetes detected should be advised, as the diabetes is usually more serious than the Graves's disease.

RELATION OF THE PANCREAS TO THE DIABETIC STATE. Just how far congenital insufficiency of the pancreas may be a factor in the subsequent development of diabetes has never been fully determined. That insufficiency of the pancreas in children does occur is reiterated by Terreros,⁴⁸ who explains that the pancreatic function does not become installed until about the fifth month of life, and even then may not be complete for a time. This is a factor in the disturbances in children under two years who are fed too exclusively on any starch, or given meat prematurely. This throws so much work on the pancreas that it becomes exhausted. Even in older children this insufficiency of the pancreas occurs more often than generally recognized. A test-meal with a given amount of fat, for example butter, will show a much larger proportion of fat in the stools than would be the case in a normal child. More than two-thirds is passed unutilized. The stools are pasty and bulky, with visible fat, and the urine is ammoniacal.

It seems reasonable to suppose that if the external secretion of the pancreas is insufficient in early life the internal might be likewise so, and as the diet increases with age it may be unequal to the task of controlling the sugar tolerance and eventuate in diabetes. Faroy⁴⁹

⁴⁸ *Siglo Médico*, Madrid, 1919, lxvi, 3412; Abstract, Journal of the American Medical Association, 1919, lxxiii, 304.

⁴⁹ *Bulletins de la Société Médicale des Hôpitaux*, Paris, 1919, xliii, 234.

reports a case to show how a patient with insufficiency of the pancreas might be benefited, insofar as the external secretion is concerned, by the administration of pulverized pancreas by mouth the influence, however, on the symptoms of diabetes remaining unchanged. The experiments of Ervin⁵⁰ would seem to indicate that the internal secretion of the pancreas is an enzyme similar to the external secretion but diverted into the portal blood for the rapid synthesis of glucose into glycogen. The failure of its action is the cause of the state of pancreatic diabetes; a diabetic is one who fails to synthesize the absorbed glucose into glycogen at a sufficiently rapid rate to prevent a hyperglycemia.

Our lack of knowledge as to the exact structural change in the pancreas which is accountable for diabetes is illustrated again by the experience of Labbe⁵¹ who examined the pancreas in 19 diabetic cadavers and in 37 non-diabetics. No connection between the lesions in the pancreas and the intensity of the diabetes was apparent, and sometimes the pancreas seemed absolutely sound in the graver cases of diabetes. But as a general thing many of the islands of Langerhans were pathological, and transitional states from islands to acini were frequent, while the reverse was rare. In 30 of the 37 non-diabetic cadavers, the pancreas was as pathologic as in many of the diabetics, and the lesions were of the same type in both, but in none was there such extreme sclerosis as was found in some of the diabetic cases. Thus, neither histology nor pathologic anatomy reveals the secret of the diabetic process. There is no specific diabetic lesion in the pancreas, and we may well be guarded in our interpretation of the physiology of pancreatic lesions. Barlaro⁵² reports the microscopic examination of the pancreas from a diabetic, aged thirty-two years, who died in the hospital. The organ seemed normal except for the conspicuous absence of islands of Langerhans. The ovaries also seemed normal except for absence of follicles. No other abnormalities of the endocrine system could be found.

DIABETES AMONG JEWS. It is fairly generally conceded, following the testimony of many physicians who have had a large experience with diabetes, that it occurs from two to six times as frequently among the Jews as it does among the people around them. It is interesting to note that during the past year Epstein⁵³ has called into question this belief. He states that historically the Chinese literature of six centuries B. C. contains definite mention of most of the cardinal symptoms of diabetes, while none is found in the early history of the Jews. The Biblical reference to carbuncles and boils and the Talmud reference to bulimia may have been due to other diseases. He states further that a disease which, as a rule, is so striking as diabetes in its manifestations could scarcely have escaped the attention of the Hebrew sages. History would seem to show that in ancient times the Jewish race was

⁵⁰ *Journal of Laboratory and Clinical Medicine*, 1919, iv, 711.

⁵¹ *Annales de Médecine*, Paris, 1919, vi, 204.

⁵² *Prensa Medica Argentina*, 1919, v, 319.

⁵³ *Modern Medicine*, 1919, vol. i, 1.

relatively, if not entirely, free from diabetes. With regard to the alleged great frequency among the Jews of today, Epstein asks this question—What circumstance then has been responsible for the remarkable change in this people to render them exceptionally prone to it now? One of two deductions is quite in place: either the mode of living of the Jews in the past few centuries has been so totally different from that of other peoples as to produce a profound and indelible impression upon their physical being such as to be transmitted from generation to generation; or the data upon which the current view concerning the prevalence among the Jews is based are insufficient and erroneous. Arguing upon the assumption in which he is joined by many others, namely, that the increase in diabetes generally is largely the result of more careful examination of the patients by doctors, rather than an actual increase in the disease, he states that the Jew in contrast to the Gentile, seeks medical advice on the slightest provocation. The Jew is anxious about himself, demands an explanation for his symptoms, and often is not content with one opinion. The Gentile, on the other hand, discredits his maladies and goes to the doctor only when forced to do so by great suffering or disability. He discounts the signs of disease and often interprets symptoms according to his own imperfect understanding. He, therefore, seeks relief for his symptoms far more frequently from nostrum vendors and spiritual healers than the Jew.

Epstein also states that the Jews are, and for many years past have been, preëminently city dwellers. As such, they have always had ready access to advanced medical opinion. He states that if the tendency to diabetes were a racial characteristic, heredity would naturally be an important factor, since Jews are exclusive in their marriages and even at times marry in close relationship which would tend to accentuate physical and other defects. He quotes Joslin's statistics, which are perhaps the largest available, as showing the heredity of 27 per cent. among Hebrew patients and 21 per cent. among non-Hebrews, a disproportion which is not great, considering the greater stated frequency of the disease between the two groups. At any rate, says Epstein, far better evidence of the predominance of the hereditary factor among the Jews than that which we possess is required in order to prove that racial proclivities play the part commonly assigned to them.

In discussing the dietetic factor, Epstein states that the Jew is likely to be overindulgent in respect to food. The high proportion of stout people among them is in itself good proof that they consume more food than is warranted by the body requirements, for the physical habits of the Jew are usually such as to make the natural food requirement rather low. His occupations are sedentary and he rarely selects pursuits which require the expenditure of great physical effort. In sport and exercise he indulges but little, and that only on rare occasions. Epstein points out that the characteristics, particularly the nervous and psychic disturbances which predispose the Jew to diabetes, are not racial, but acquired by reason of their environment. History supplies

enough facts to account fully for the instability of their nervous systems. The individual Jew, eager to progress, ambitious, enters the life struggle, where it is most intense, namely, in the city. He makes his life strenuous by preference. For reasons of prophylaxis or prevention it is safer to assume that Jews actually do fall prey to this disease more often than non-Jews, but it must be clearly understood that this predilection is through circumstance, temperament and choice of habits—all controllable conditions—rather than through any racial proclivity.

The Jew must be informed that he possesses many attributes which render him more vulnerable than other people, but that he can overcome them by properly directed effort. Moderation in the mode of living, mental poise and physical self-discipline are attributes which he must develop in order to lessen any existing tendency to nervous instability and to nutritional disorders.

TREATMENT OF DIABETES. That the Allen method of treating diabetes has come to stay, is evidenced by increasing experience. Fitz and Bock⁴⁴ record an interesting observation of the efficacy of the treatment in a case of maximum severity. At entry to hospital their patient had a blood-sugar concentration of 0.58 per cent. and an acidosis sufficient to lower his alveolar CO₂ tension to 20 mm. During the first twenty four hours in the hospital he excreted 116 grams of glucose and 6.98 grams of ammonia nitrogen. These facts show that the patient was critically ill. On the third day of a carbohydrate-free diet the patient's urine showed a D = H ratio of approximately $3.65 = 1$, and afforded additional evidence that the case was one of maximum severity. The patient was treated according to the method proposed by Allen, and illustrates its value in a favorable case. A seven days' fast was necessary to render the patient's urine free from sugar. At the end of this period the blood-sugar had fallen to 0.17 per cent., the alveolar CO₂ tension had risen to 44.8 mm., the ammonia nitrogen excretion had fallen to 1.37 grams, and the patient's condition was much improved. After the urine was sugar-free, the carbohydrate tolerance was tested by a systematic daily increase in as pure a carbohydrate diet as was possible to be obtained in the form of green vegetables. The patient tolerated 150 grams of carbohydrate by this method without becoming glycosuric. During this time the blood-sugar fell to normal, and was not found materially increased on the last day of the test, when repeated bleedings were made to determine the degree of post-absorptive hyperglycemia. During the period of carbohydrate feeding, the alveolar CO₂ tension remained high, and the ammonia nitrogen excretion dropped to about 0.30 grams in twenty-four hours, showing that all acidosis had disappeared. The carbohydrate-sparing effect on protein metabolism was demonstrated. The nitrogen excretion dropped from about 19 grams in twenty-four hours on the last day of the fast to about 7.5 grams when protein intake was low. As the vegetable protein increased considerably, the urinary nitrogen increased somewhat. After thirty-three days' observation the patient

⁴⁴ Quarterly Journal of Medicine, 1919, xii, 307.

was discharged from the hospital in good condition with normal blood-sugar concentration, with trivial acidosis, and approximately in nitrogen equilibrium upon a mixed diet within his tolerance yet ample or his bodily needs.

The "Therapeutics" column of the *Journal of the American Medical Association*⁵⁶ contains the following terse and practical remarks which may well be kept in mind as one approaches the treatment of a diabetic:

1. Every possible cause should be sought and all side irritations and infections (if present) should be removed.

2. Inherited tendencies should be ascertained, both as to diabetes and to obesity.

3. The prognosis, even in childhood, is much better than it was before Allen clarified the diet treatment.

4. Loss of weight, even in the thin, need not be a matter for worry.

5. The amount of sugar lost per day on an ordinary diet and on ordinary exercise should be ascertained.

6. The presence or absence of diacetic acid and acetone bodies should be noted.

7. If the case seems a mild one, the starvation period may be taken with the patient up, but at home. If the case is severe, especially if there are signs of increased acidity, he must be in bed, as any muscular exercise adds to that acidity.

8. All fats should be excluded from the diet for several days before the starvation period is begun.

9. During the starvation period the patient should receive plenty of water with perhaps some clear tea or coffee. Mineral waters are of advantage.

10. Ordinarily the patient should be sugar-free in forty-eight hours. If he is not, the starvation period may be prolonged another day or two.

11. If the heart is weak and coffee does not help it, strychnine in doses of $\frac{1}{60}$ grain once in four hours, may be given, or digitalis may be given.

12. If diacetic acid, beta-oxybutyric acid and acetone are dangerously increased in amount, whisky may be given, about $\frac{1}{2}$ ounce every three hours. Sodium bicarbonate is the most used treatment for this condition, and the dose must be large by the mouth; by the rectum in 10 per cent. solutions (perhaps by the Murphy-drip method); and from 2 to 4 per cent. may be given, slowly, intravenously in physiologic sodium chloride solution. If there is edema, which is a bad symptom, the alkali either should not be given, or given in small doses only. It has been suggested that perhaps it may be better not to give an alkali which may protect the dangerous ammonia from being used to neutralize the extra acid.

13. When the urine is sugar-free, the use of foods containing a little starch should be begun to find the limit of tolerance; then small amounts of protein should be added, and later very small amounts of fat.

⁵⁶ *Journal of the American Medical Association*, 1919, lxxii, 1676.

14. The danger in a diabetic diet is the withdrawal of carbohydrates and the coincident allowance of too much fat. Sodium bicarbonate seems to help a diabetic properly to metabolize starch.

15. Constipation should be prevented.

16. There should be a fast day once a week. If the case is a mild one, this may be a green vegetable day or an oatmeal day.

17. If these patients cannot take, or are not allowed to take, milk, some extra calcium should be given, perhaps as lime water.

18. Mild exercise is of advantage in diabetes; hard exercise is bad in severe diabetes, as it tends to precipitate an acidemia.

19. Even if the urine is sugar-free, there may be a hyperglycemia. Also, acidosis may occur without diacetic acid in the urine. Hence the patient should be carefully studied, even with normal urine.

20. If a diabetic is to undergo an operation, fats should be excluded from the diet and starches should be reduced but not absolutely removed; alkalis should be increased before the operation.

21. A diabetic woman becomes more acid during menstruation.

22. A diabetic should always dress warmly, and, if possible, he should go to a warm climate.

23. If a pregnant woman has a large amount of sugar in the urine which is not readily prevented by diet, consultation should be had as to the advisability of causing abortion or promoting premature labor.

A mistake which was made in the past in the treatment of diabetes was the overfeeding with fat in the effort to bring up the caloric requirement of the diet. Allen, in particular, has pointed out the menace of overfeeding with fat. In last year's issue of *PROGRESSIVE MEDICINE* we called attention to Mosenthal and Clausen's observation that probably the lowest diet that will conserve the mental and physical efficiency of the diabetic is the most desirable diet. They alleged that a patient can be kept in nitrogen equilibrium on a carbohydrate-free diet containing 1500 to 2000 calories. More recently, Mosenthal and Harrop⁵⁶ attempted to determine which of the ingredients of carbohydrate-free dietary, that is, fat, protein or alcohol, are the most efficient protein-sparers. They found that the addition of an equal number of calories of protein, fat or alcohol, to a low caloric carbohydrate-free diet in cases of diabetes results in the assimilation of considerable amounts of nitrogen when the protein is used; a favorable balance only occasionally in the instance of fat and no change in nitrogen equilibrium when alcohol was given. They conclude that a high protein diet is the most advisable low-calorie, carbohydrate-free diet by which to conserve the body tissues and furnish the maintenance ration for the diabetic.

Diabetes and syphilis are illustrated in an interesting case report by Mitchell,⁵⁷ who observed two lessons from his experience with the patient: (1) Though probably diabetes is relatively infrequently due to syphilis, search for this cause, whether inherited or acquired, should be carefully made by all possible means and merely a negative Wasser-

⁵⁶ Archives of Internal Medicine, 1918, xxii, 750.

⁵⁷ American Journal of Medical Sciences, 1919, clvii, 700.

mann reaction in the blood should not be accepted as excluding it; (2) diabetes, particularly in the advanced stage, may not be (and probably, as a rule, is not) perceptibly altered by antiluetic treatment. This is logical from the fact that syphilis presumably produces fibrous changes in the pancreas just as it does in the liver. What can be hoped from such therapy is the checking of further advance of the infectious process, not the repair of existing damage and the improvement of diabetes. Such cases stand practically on the same plane as diabetes from other causes, and the same dietary control is necessary. The diabetes in this case was of marked severity, as shown by the minimal tolerance acquired in long treatment. The patient was benefited in respect to strength, comfort and presumably longevity, but the ultimate outcome in view of the advanced conditions present is dubious.

The use of *saccharin* (benzosulphinidum U. S. P.) in the place of sugar to sweeten coffee and foods has been widely used, although many have felt that it was not devoid of evil effect on diabetics because of a retarding action on the digestive ferments. Bürge⁵⁸ reported experiments from which he concluded that saccharin was helpful to diabetics in addition to serving as a sweetener by reason of the fact that it facilitated oxidation and was not harmful as some have claimed.

OPERATIONS ON DIABETICS. Apart from urgent cases, such as strangulated hernia or perforative peritonitis, in which operation is imperative, the question may otherwise arise as to whether a given operation is justifiable and when it should be performed. It has been pointed out⁵⁹ that the difficulties are all the greater as diabetes and the surgical affection have a reciprocal baneful influence and a vicious circle is created. The question may be asked as to whether the operation should be carried out at once to remove the lesion which exerts an unfavorable influence on the diabetes; or, should an attempt be made to render the urine free from sugar, or at least to reduce the glycosuria so as to cause an improvement in the lesion and thus render the conditions more favorable for operation? Much may be said in defence of either step. Numerous instances have occurred of surgical affections in diabetes which have healed spontaneously after disappearance of sugar from the urine, while, on the other hand, it often happens that after successful operation the diabetes takes a mild course and shows an improvement characterized by diminution of glycosuria and disappearance of the acetonuria. The difficulty of deciding in these cases is increased by the fact that a surgical operation exposes the diabetes patient to great danger, which is chiefly connected with the anesthetic and operative shock.

Blum⁶⁰ distinguishes between the surgical affections which are quite independent of the diabetes and those connected with the disease. The general rules of surgery apply to the former, but with the lesions determined by the diabetes or connected with it, preliminary dietetic treatment is imperative.

⁵⁸ Medical Record, 1919, xciv, 1071.

⁵⁹ Lancet, May 31, 1919, p. 945.

⁶⁰ Paris Médical, 1919, ix, 341.

Labbe,⁶¹ on the other hand, declares that while it is advisable to refrain from operations on diabetics, especially when there is acidosis, yet it is better to operate than to let the patient die from septicemia or from the acidosis which it induces. When possible, the operation should be preceded by measures to reduce the hyperglycemia and the acidosis. This can be accomplished by a mixed diet with little meat and not much carbohydrate, if the patient does not exhibit acidosis. Sodium bicarbonate should be given in sufficient amounts to render the urine alkaline. Another precaution is to refrain from imposing the usual fast just before the operation. It might be well besides to give 40 grams of sodium bicarbonate before. The choice of the anesthetic is extremely important. Local anesthesia should be preferred; if this is not possible the next choice is spinal anesthesia. If a general anesthesia is necessary, ethyl chloride should be the choice; chloroform or ether should never be used on a diabetic with acidosis. After the operation, enough sodium bicarbonate should be given to render the urine alkaline. As soon as nourishment can be taken, vegetable broth should be given or oatmeal gruel, soft mashed peas or beans or milk. The alkaline treatment should be continued until the acidosis has disappeared.

ACIDOSIS IN DIABETES. The patients who die of diabetes itself die in "diabetic coma," and it is therefore the symptom most to be feared and to be most promptly combated. Its early recognition is facilitated by certain laboratory methods which are directed toward the detection of the underlying factor, namely, the reduction in the alkaline reserve of the blood. The fall in the plasma bicarbonate begins before the symptoms of acidosis appear and the fall more or less parallels the severity of the symptoms. Stillmann⁶² describes the methods employed at the hospital of the Rockefeller Institute to detect, as early as possible, the development of acidosis and to prevent its progress, and typical examples are given of patients of each of the four following groups in which it is practically possible to divide them:

Group 1. 46.8 per cent. of cases. No tendency to acidosis, either on fast or ordinary diet, regardless of degree of glycosuria.

Treatment. Made aglycosuric without danger by continuous fast. Can usually be made to tolerate fairly high calory diet without glycosuria or ketonuria. Easiest group to handle. Best prognosis.

Group 2. 32.3 per cent. of cases. Received in condition of moderate or severe acidosis (plasma bicarbonate CO_2 below 40 volume per cent.), which clears up on fast.

Treatment. Made free of glycosuria and acidosis by continuous fast. A tendency toward acidosis is present, and the safely tolerated maintenance diet is usually lower than in Group 1.

Group 3. 14.5 per cent. of cases. Tendency to slight acidosis (subnormal plasma bicarbonate) on any but most carefully chosen diet. Acidosis not increased by fasting.

Treatment. Glycosuria removed by continuous fast. Tolerated

⁶¹ *Annales de Médecine, Paris*; Abstract, *Journal of the American Medical Association*, 1919, lxxii, 610.

⁶² *Archives of Internal Medicine*, October 15, 1919.

maintenance diet variable. Usually there is a tendency toward acidosis which may become acute on any improper diet.

Group 4. 6.4 per cent. of cases. Either develop or retain severe acidosis (plasma bicarbonate CO_2 below 30 volume per cent.) when fasted to attain the aglycosuric state. This is incomparably more severe than the mild acidosis observed as a rule, when normal individuals are fasted, and may rapidly become fatal unless the fall in plasma bicarbonate is checked.

Treatment. Continuous fast must be given up for intermittent fast (described below). As in Group 2, the presence of a tendency toward acidosis is demonstrated and must be considered in the future feeding and observation of the patient.

Stillman gives typical case notes illustrating these groups as follows:

Group 1. A patient, aged fifty-four years, diabetic for five years, emaciation and clinical symptoms of moderate severity, but mild in ability to tolerate a sufficient diet for maintenance.

The table shows no tendency to acidosis during the period of preliminary observation (January 25 and 26) or during the fasting period (January 28 to 31). The subsequent carbohydrate tolerance test (February 1 to 16) shows a tolerance of at least 150 gm. of carbohydrate when given in the form of green vegetables alone. At this point the patient refused further hospital treatment, but subsequently he tolerated a maintenance diet of 40 calories per kg. body weight, including 30 gm. carbohydrate and 1.5 gm. protein per kg. of body weight (from January 25 to February 16, 1916).

Group 2. A patient, aged thirteen years, diabetic one year, extreme acid intoxication. He was admitted on the verge of coma, being so stuporous that it was impossible to attract his attention by any means. The combining power of the blood for CO_2 (12.2 volume per cent.), agreed with the clinical picture in indicating extreme acidosis. Therefore, the usual preliminary observation period was omitted. Fasting was immediately instituted, and sodium bicarbonate given by mouth. Within twenty-four hours the CO_2 combining power of the plasma had risen to 26.8 volume per cent., and there was a corresponding improvement in the clinical condition of the patient, consciousness having completely returned and signs of coma having disappeared. After five days' fast the plasma CO_2 was nearly normal for a child, thirteen years of age; the patient was alert and apparently in as good condition as could be expected in a normal child after such a fast. The fast was continued for four days more, however, until the patient became aglycosuric.

The subsequent carbohydrate tolerance test showed a tolerance of 90 gm. of carbohydrate when given in the form of green vegetables alone, and a maintenance diet of 40 calories per kg., body weight, including 30 gm. of carbohydrate and 2 gm. of protein per kg., was tolerated without glycosuria or acidosis.

A year and a half after admission word was received that the patient had died in coma following a break in diet. (From February 22 to March 28, 1916.)

Group 3. A patient, aged twenty-seven years. Diabetic four years, severe in carbohydrate intolerance and in a continuous low-grade acid intoxication despite dietetic treatment. There was a low grade acidosis during the preliminary observation diet (October 15 and 16) and during the subsequent fasting period (October 17 to 25). During the carbohydrate tolerance test (October 25 to November 6) the plasma bicarbonate barely rose above the minimum normal (53 volume per cent. CO_2), never approaching the average normal (65 volume per cent.), and on the maintenance diet (November 8 to 10) it again fell just below 53. (From October 15 to November 10, 1915.)

Group 4. A patient, aged seventeen years, diabetic one year, was severe in carbohydrate intolerance, and admitted with a dangerous degree of acidosis (plasma CO_2 26.4 volume per cent.). The patient fasted for seven days before admission, following, he thought, the technic employed in this hospital, which he had experienced on two previous admissions.

The summary shows a case in severe acid intoxication (plasma CO_2 26.4 volume per cent.) on admission to the hospital, after a fast of seven days at home. The fast was continued for another day under hospital observation. This was followed by a further drop in the plasma CO_2 of 2.2 volume per cent., which, at this low level, with the onset of hyperpnea and his history of fasting at home, was taken as indication enough to interrupt the fast. The second day in the hospital the patient was put on a diet of lean meat and eggs, constituting 19 calories per kg. body weight. This was accomplished by sodium bicarbonate by mouth. The following morning the hyperpnea had vanished and the plasma CO_2 had risen to 34.3 per cent. The diet was gradually cut down during the next ten days and the bicarbonate therapy continued until the patient had a normal plasma CO_2 . The subsequent fast of five days made the patient aglycosuric and cleared up the ketonuria (Gerhardt reaction).

A carbohydrate tolerance test was given after the fasting period. This was so low (only 30 gm. of carbohydrate when green vegetables alone were given) that a second carbohydrate tolerance test was attempted, as it was thought probable that the severe acidosis present on admission had in some way mitigated against a higher tolerance. The second test confirmed the first.

The maintenance diet was then gradually built up to 1550 calories (39 calories per kg. body weight), which included 2 gm. of protein per kg. body weight. No carbohydrate was tolerated on mixed diet. The patient died a year later in coma.

Stillman uses the term "maintenance diet," by which is meant a mixed diet, which is as near a normal diet as can be tolerated without glycosuria and with fully normal plasma bicarbonate. After having made the patient aglycosuric and having determined the carbohydrate tolerance, he is placed on a trial maintenance diet.

THE TRIAL MAINTENANCE DIET PER TWENTY-FOUR HOURS.

Carbohydrate.	Protein.	Fat.
One-tenth the amount tolerated on the carbohydrate tolerance test,	1.5 gm. per kg. body weight.	Sufficient to bring the total caloric value of the diet to 35 calories per kg. of body weight,

If the diet is well tolerated and the patient appears to need more, an increase is made in the constituents of the diet which appear to be most needed. Care is taken that only one of the three constituents, either the fat, the protein, or the carbohydrate, is increased at a time and in a gradual systematic manner, so that should glycosuria or ketonuria result the offending food could be recognized and reduced.

Jonas⁶³ says in regard to acidosis: (1) When bicarbonate of soda is administered in excess of normal requirement, it is eliminated in the urine and an alkaline reaction results. In many diabetics there is a lessened permeability of the kidneys due to disease, with the result that the urine remains acid even after a sufficient amount of bicarbonate has been given to bring about normal alkaline reserve. There is some danger that a state of alkalosis with symptoms of tetany may result. It is better, therefore, to determine (2) the alkaline reserve of the blood. For this purpose one can utilize either the Marriott⁶⁴ test for alveolar air CO₂ tension or the Van Slyke⁶⁵ test for blood CO₂ content, since both of these tests depend upon the amount of alkaline base available to form sodium bicarbonate. The Van Slyke test is more delicate, requires no coöperation on the part of the patient, and is less likely to errors, such as irritability of the respiratory center, excitement, pathologic condition or influence of drugs which may affect the respiratory center. (3) The determination of the amounts of ketone bodies in the blood and urine gives us an idea of the intensity of the disturbance of fat metabolism and resulting acidosis. For this purpose, the VanSlyke⁶⁶ method which must, however, be done in a chemical laboratory, is advised. It is not as feasible for the general practitioner as the tests described under (2), above, especially the alveolar air CO₂ tension test of Marriott, which is exceedingly simple. (4) The determination of the ammonia content of the urine as an index of the degree of acidosis is satisfactory, but not the method of choice.

Case reports are always interesting, especially when they show evidence of scientific study correlated with clinical study. The following case report of Jonas is interesting in this connection: A boy, aged ten years, with a recent history of chicken-pox, was admitted to the University Hospital, January 23, 1918. Shortly after his recovery from the chicken-pox the father, a physician, noticed that in December, 1917, the boy was languid, losing weight, and drinking more water than usual. On examining the urine, he found 5 per cent. of sugar, and traces of acetone and diacetic acid. The boy was immediately put on a restricted carbohydrate diet and admitted to the hospital. On the following day the laboratory reported the following: Total nitrogen, 10.1 gms.; glucose, trace; ammonia nitrogen, 1.08 gms.; total ketones, 7.96 gms.; blood carbon dioxid, 58 volumes per cent.; blood-sugar, 0.29 per cent. After fasting for several days the urine became sugar-free, blood-sugar within normal limits, ketones gradually reduced to 0.148 gms.

⁶³ Pennsylvania Medical Journal, 1919, xxii, 718.

⁶⁴ Journal of the American Medical Association, 1916, lxvi, 1594.

⁶⁵ Journal of Biological Chemistry, 1917, xxx, 347.

⁶⁶ Ibid., 1917, xxxii, 455.

After the addition of carbohydrate to the diet, within two weeks ketone bodies had disappeared from the urine, glycosuria disappeared and at no time since has the urine shown any of the characteristics of a diabetic specimen. The urine and blood have been quantitatively studied weekly until June and at all times was within normal limits. Carbohydrate has been gradually added to the diet until the amount reached about three-fourths what it was before patient became ill. The blood-sugar, September 14, was 0.111 per cent. one and one-half hours after breakfast.

The boy is growing, is full of vigor, attends school regularly and is apparently well. His diet is still carefully controlled and as a matter of precaution his carbohydrate will be somewhat restricted for an indefinite time, increasing the number of calories at intervals to keep pace with his normal growth and increase in weight.

ACIDOSIS IN THE INFECTIONS AND FOLLOWING STARVATION. The occurrence of *acidosis in scarlet fever* was studied by Thomas,⁶⁷ who examined daily the urine of 7 consecutive patients, estimating the acidity, the proportion of urea and ammonia-amino nitrogen and testing for acetones and diacetic acid, with the following results: (1) Acidosis lasting from three to twelve days, reaching its maximum on the third to fifth day of the disease; (2) acetone and diacetic acid not always, though generally, present; (3) urine not alkaline during administration of sodium bicarbonate from 10 to 15 grains every four hours; (4) one return of acetone, increase in ammonia nitrogen from 1.7 to 6.3 per cent., and rise in acidity from 2 to 78 per cent. tenth-normal acid, after halving the dose of soda; (5) development of nephritis later in the two patients who showed the most severe acidosis. As sodium bicarbonate did good in moderate and severe cases, Thomas has made it a routine for all, with satisfactory results. It is given for a week to ten days to all children who have scarlet fever, the dose being regulated by the reaction of the urine.

Asada⁶⁸ reports an observation of acidosis in animals during starvation, using plasma bicarbonate determinations. On the first and second days of starvation the plasma bicarbonate in the arterial blood of rabbits showed a drop from the normal value. On the third day of the fast there was a second rather sharp fall, after which there was no change until the ninth day. On the tenth fasting day there occurred a third rather moderate fall, after which no further marked change took place until the end of life. Generally, the arterial plasma of rabbits has 55 volume per cent. of carbon dioxide. The first fall is about 5 volume per cent., the second about 10 and the third about 6 volume per cent. The amount of carbon dioxide in the arterial plasma is influenced considerably by the condition of the animals. After one extraction of 10 c.c. blood from the carotid, the acidosis seems to be conspicuously increased, because by the second extraction the amount of carbon dioxide is always less than that of the first extraction on the same fasting day. In the moribund state, a contrary result is obtained, *i. e.*, the amount of

⁶⁷ British Medical Journal, 1919, ii, 274.

⁶⁸ American Journal of Physiology, 1919, l, 1.

carbon dioxide in the arterial plasma does not decrease, but increases. This is also the case in the arterial plasma immediately after death. In Asada's opinion this increase is not due to bicarbonate, but rather to an accumulation of carbon dioxide caused by the failure of the circulatory as well as the respiratory functions. The rate of the loss of body weight is subjected to wide individual fluctuations which may or may not be influenced by the blood extraction. The animals lived in the state of an absolute fast for from eleven to twenty days and at the end of life had lost from 27.69 to 52.37 per cent. of their initial weight. Microscopically, many organs showed cloudy swelling, vacuolarization and atrophy. There was invariably an intensive congestion in every glandular organ, but fatty degeneration was found almost in no case.

IODINE URINE TEST FOR ACIDOSIS. This test has been devised by Mitchell⁶⁹ who states, while it is true that normal urine has the property of decolorizing weak solutions of iodine, the increase in power to decolorize, shown by the urine of acidosis of diabetes mellitus and of pregnancy, is not due to uric acid, creatinine, etc., in increased percentage. Urines containing unusually high percentages of these constituents have been tested by the writer and found not to decolorize iodine to anywhere near the same extent as does the urine of acidosis. Moreover, sugar is not the agent which accomplishes the decolorization. If a patient suffering with the acidosis of diabetes mellitus be fasted until just such a time as the sugar has left the urine, but before improvement from acidosis has had time to manifest itself, it will be found that the amount of urine necessary to decolorize the solution described below will be small, usually less than 10 c.c. Hence sugar did not cause the decolorization. Again, if this same patient be kept under observation until, by cautious feeding, he has improved measurably, and until the uric acid, creatinine, etc., have increased in the urine, it will be found that the amount of urine needed to decolorize the iodine rises above 10 c.c., and keeps on rising until it is practically normal, that is above 20 c.c. The test is applied as follows:

To 145 c.c. of water (hydrant water will do) are added 3 c.c. of Lugol's solution and 2 c.c. of a saturated solution of picric acid, the whole being thoroughly mixed. The result is a fine, clear, reddish liquid of bright color. Pour this liquid into a white dish and heat it on the water-bath to a temperature of 180° F., but if a water-bath is not available it may be heated over the flame until fumes are abundantly given off, boiling being avoided by turning down the flame sufficiently. When thus heated, the urine is added as quickly as possible but in small amounts at a time, using for this purpose a graduated buret. If, however, a buret is not available, a small graduate or graduated bottle may be used from which to pour the urine into the hot liquid. In acidosis the amount of urine needed to turn the bright red color to a bright yellow color is small, and the smaller the worse the case. In severe cases 2 or 3 c.c. of urine will almost immediately discharge the red color. In cases of moderate severity 8 or 10 c.c. may be required. Normal urines do not usually

⁶⁹ Medical Record, 1919, xcv, 404.

affect the color in smaller amounts than 15 c.c., except possibly in unusual conditions of concentration, when the amount of urine in twenty-four hours may be but a few hundred cubic centimeters. In most cases of normal urine, of specific gravity ranging from 1.015 to 1.020, the amount of urine required to effect change from red to yellow is around 20 c.c., or even higher, as high as 50 c.c. in some cases.

PENTOSURIA. This condition which is characterized by the presence in the urine of pentose, that is, carbohydrate containing 5 atoms of carbon $C_5H_{10}O_5$, is considered rather uncommon. Cammidge⁷⁰ calls attention to the fact which others are beginning to believe, namely, that it is not as rare as we had supposed. During one month in which Cammidge saw 50 cases diagnosed as diabetes mellitus, 11 proved to be passing pentoses in their urine. Nine were of the alimentary type in which the sugar was l-arabinose and 2 were cases of true or essential pentosuria, one of which was i-arabinose and the other i-arabinose and dextrose. It is well to recall that l-arabinose rotates polarized light to the right, while i-arabinose is optically inactive unless some other sugar is present as well. An alimentary pentosuria usually results from the ingestion of large quantities of pentose-rich foods, such as prunes, cherries, grapes, plums and fruit juices. Essential pentosuria is usually chronic and bears no relation to the quantity and nature of pentose containing foods ingested. As Cammidge points out, alimentary pentosuria is perhaps commonly associated with hepatic disturbances, and it is particularly to this lesion that the lowered tolerance for pentose is due. The amount of fruit taken by Cammidge's patients was in no case large and in all of them analysis of the urine revealed evidence of hepatic insufficiency. The two cases of essential pentosuria had been treated for diabetes for some time before coming under observation, one for sixteen years and the other for one year. An editorial in the *Lancet* for July 19, 1919, calls attention to the fact that alimentary pentosuria is liable to cause mistakes in diagnosis, especially at the time of the year when fruit is being eaten more extensively than at other seasons. The tolerance limit for pentoses is small, about $\frac{1}{2}$ gram, and even in healthy people a surfeit of cherries will cause the appearance of the sugar in the urine. The amount of sugar excreted is usually small, 0.5 per cent. or under, and as arabinose does not reduce as readily as dextrose the reaction is delayed and is often of a peculiar type. When, for example, the urine is added to Fehling's or Benedict's solution and boiled, no change occurs for a time, but after continued boiling the color of the solution suddenly changes to green, no turbidity occurring even when the heating is prolonged. As pentoses are not fermented by yeast, the reducing power of the urine in cases of pure pentosuria is not impaired by mixing it with yeast and standing in a warm place for twenty-four hours. If doubt still remains, the orcin test or Tollen's test may be applied. Castellani and Taylor⁷¹ report a case of pentosuria contracted in the tropics. A planter, aged thirty-eight years, had been sent home from the tropics of the Far East with the diagnosis of diabetes. He

⁷⁰ *Lancet*, 1919, cxcvii, 175.

⁷¹ *Journal of Tropical Medicine and Hygiene*, London, July 1, 1919.

presented, however, no evidences of the disease. He was nervous and irritable and worried at the idea of suffering from diabetes. The urine passed in twenty-four hours varied between three and four pints. It was acid, sp. gr. 1020, and persistently reduced Fehling's solution, upon which fact, apparently, the diagnosis had been based. In the differentiation they resorted to the mycological tests which were reported by them in 1917. The mycological tests were positive, as also the orcin test. They call attention to the importance of differentiating glycosuria and pentosuria, as the first is often of grave progress, while the second points to a much more benign disorder of metabolism, requiring no treatment, as a rule. They give in their article the table of the mycological formulæ useful in differentiating the various sugars.

DISORDERS OF GLANDS OF INTERNAL SECRETION.

Thyroid Gland. The isolation of the active principle of the thyroid gland is a scientific achievement which redounds to the credit of American medicine. The investigation was begun by Kendall, in 1910, at the St. Luke's Hospital, New York. In December, 1914, the chemical entity—thyroxin—was isolated. In the summer of 1917, the structural formula—trihydro- triiodo-oxy-beta-indolpropionic acid was worked out. Osterberg succeeded in synthesizing thyroxin with its 60 per cent. of iodine in December, 1917, and the synthesis and formula have since been confirmed by Kendall. Recently, Kendall⁷² has reviewed the investigation of the chemical constituents of the gland and the method of isolation of the iodine-containing compound in pure crystalline form. It is not within the province of this article to describe the technical details of this work. The reader can secure them by consulting Kendall's paper. It is important to note, however, that in the isolation of thyroxin considerable technical knowledge is necessary in order to prevent the breaking off, so to speak, of the iodine compound. Furthermore, one of the most important reasons for the failure to separate thyroxin consistently was the variability of the samples of desiccated thyroid used. Analysis of the samples obtained at different times of the year shows that in the winter months, January, February and March, the iodine content of the glands may be so low as to make the isolation impracticable. During the summer months the thyroxin content of the gland increases from 400 to 500 per cent., and allows a much more liberal and much simpler purification of thyroxin. The amount of impurities present appear to be more nearly constant, so that in the winter months the problem is greatly complicated by having to deal with approximately the same amount of impurities and with a greatly diminished amount of thyroxin. It is significant that the real progress was made with the problem only when a satisfactory sample of desiccated thyroid was obtained, but this was demonstrated only after the completion of the work. Another influence, which undoubtedly is very important, not only in the isolation of the substance but in the con-

⁷² Journal of Biological Chemistry, 1919, xxxix, 125.

sideration of the therapeutic value of any sample of desiccated thyroid is the state of preservation of the thyroid proteins. Thyroxin has been shown to contain two carboxyl groups and one amino group when existing in open-ring form, in which state it undoubtedly does exist in the thyroid proteins. Deamination and decarboxylation by bacteria are well known, and it seems highly probable that some samples of desiccated thyroid are without therapeutic value because of bacterial decomposition. Bacterial action could very readily result in deamination and decarboxylation of thyroxin, which would render the substance without physiologic activity, although the iodine content of the material would not be altered. Successful thyroid medication demands that the desiccated glands should contain not only the U. S. P. requirement as to iodine, but the proper amount of the active principle thyroxin.

The importance of iodine and its compounds for the proper functioning of the healthy organism was discussed editorially in the *Journal of the American Medical Association*, September 13, 1919. The value of the iodides in children living in goitrous districts and in the fetal athyreosis of domestic animals is well known. It is also known that in thyroid lesions the amount of iodine present is inversely proportional to the degree of hyperplasia of the gland; and when the hyperplastic condition becomes fully developed, scarcely a trace of iodine is left in the gland. When the hyperplasia gives place to colloid goiter, the iodine increases both relatively and absolutely. Moreover, it has been found that if an iodide is administered to an animal suffering from hyperplasia, the hyperplastic condition promptly disappears and the animal becomes normal.

The difficulty encountered in the study of the iodine content of the tissues has been the result of the lack of an accurate method of estimating the minute quantities in which the iodine exists. Recently, Kendall, by a refined method, has estimated the amount in blood at approximately 0.015 mg. per hundred c.c. The content in the tissues is slightly greater—about 0.03 mg. per hundred gm.; in the liver it may reach 0.04 mg. per hundred gm. of this glandular organ. These statistics are of interest in indicating the extremely small amounts of iodine-containing compounds that seem to be essential for metabolic needs.

Thyroxin, the active principle of the thyroid gland, contains about 60 per cent. of iodine. This substance in 1 gm. doses has been found to increase the metabolic rate 2 per cent. when given to an individual weighing 150 pounds. Kendall estimates that this figure is in reasonable accord with the quantities of iodine actually found in circulation. It is asserted that if only a single administration of thyroxin is given, a demonstrable action may fail to be produced. Three or four successive daily administrations may be necessary in order to evoke evidences of hyperthyroidism. Kendall's explanation for this is found in his observations on the elimination of thyroxin from the body. He asserts that as much as 60 per cent. may be rapidly eliminated with the bile. In one instance 8 per cent. was found in the urine, so that a remaining one-third of the hormone introduced may be assumed to have been taken up by the thyroid gland. This, Kendall says, indicates why the

single administration does not produce a physiologic response. It is only the continued presence of the iodine compound within the body which results in the increase in metabolic activity. These findings have an obvious bearing on thyroid therapy. Swingle's⁷³ studies confirm the theory that the thyroid gland is an organ whose function is to extract, store and supply to the tissues, as needed, the iodine taken into the body.

GOITER AMONG ENLISTED MEN. One of the interesting experiences in the examination of large groups of men for military service was to note the frequency of enlargement of the thyroid gland with and without toxic symptoms. We had occasion in this article last year to call attention to the experience of Smith⁷⁴ who found enlargement of the thyroid gland in 1074 instances (1.63 per cent.) among 65,507 men at Jefferson Barracks. In 116 cases (10.7 per cent.) there were toxic symptoms. Brendel and Helm⁷⁵ likewise noted a remarkable number of thyroid enlargements at Fort McDowell, California. Many were unassociated with toxic symptoms. A considerable number, however, showed hyperthyroidism and were unfit for military service. These authors conclude that goiter is more common among young men than the experience of the general practitioner would suggest. They also call attention to the fact that the more toxic cases show a tendency to nephritis in addition to the cardiovascular disturbance and that in all men having thyroid enlargement a systematic examination should be made for evidence of cardiorenal pathology.

A survey of 21,182 troops coming to Camp Lewis, Washington, as reported by Kerr,⁷⁶ from an area of approximately one-third of the United States, showed a high incidence of simple goiter in Washington, Oregon, California and Nevada. Twenty-one per cent. of all troops examined showed a definite enlargement of the thyroid. Of these, 27 per cent. showed a large or moderately enlarged thyroid and 73 per cent. were classified as "small." The enlargement of the thyroid was noted as diffuse in 38 per cent. of the cases; isthmus in 52 per cent., right lobe in 5 per cent., and left lobe in 4 per cent. Such physical signs as tremor, tachycardia, vasomotor instability of the hands and curved nails were noted, and were found in a larger percentage of men with thyroid enlargement than in those without demonstrable changes in the thyroid.

GOITER AS A PUBLIC HEALTH PROBLEM. That endemic centers of goiter have been described on every continent is well known. In North America parts of New Hampshire, New York, the Blue Ridge Mountains of Virginia, practically the entire State of West Virginia, the region around the Great Lakes and Edmonton, Canada, constitute the main goiter areas. Tolman⁷⁷ has recently investigated the State of West Virginia and found no less than 12,000 persons afflicted with goiter.

⁷³ *Journal of General Physiology*, 1919, i, 593.

⁷⁴ *Journal of the American Medical Association*, 1919, lxxii, 471.

⁷⁵ *Archives of Internal Medicine*, 1919, xxiii, 61.

⁷⁶ *Ibid.*, 1919, xxiv, 347.

⁷⁷ *American Journal of Public Health*, 1919, ix, 511.

In Braxton County, a house to house survey revealed 1148 cases, or one in every twenty inhabitants—men, women and children. He states that probably about 2 per cent. of the West Virginia cases were toxic and directly responsible for much suffering. It is evident, therefore, that the health officer in these communities is confronted by a problem which is well worth his serious consideration. All such efforts bring into consideration the question of the water supply, and despite the reasonable certainty of the etiological relationship, we are still far from a true knowledge of what it is about the water that accounts for goiter. As Tolman points out, efforts have been made to correlate the presence of various inorganic impurities in water with the occurrence of goiter but without success. In one region, a hard water may appear to be responsible, in another a high manganese content, while in still a third the ferruginous content may come under suspicion. It will be found, however, in every case that in some other district where goiter is equally endemic one or even all three of these inorganic impurities is absent. We have, however, come to a realization that goiter is more or less definitely associated with the geologic formations from which the drinking water is derived, the upper Palaeozoic and lower Mesozoic areas being those most affected. Goiter reaches its greatest endemicity where the course of water is from rock strata of the Carboniferous period, though it occurs among the more ancient Devonian and Silurian rock and the more recent Permian and Triassic. In England, goiter is practically absent in the Silurian, Devonian and Permian formations, but is endemic in the Cretaceous from which, latter, it is practically absent in this country. Apparently, volcanic formations, the crystalline rocks of the Archaic period and all deposits laid down in fresh water are free from the goiter-producing characteristic.

The region of greatest endemicity in the United States, namely, about the Great Lakes and parts of West Virginia and Virginia are Palaeozoic areas. Goiter is also slightly prevalent in parts of New Hampshire, and here again this formation occurs. We again find the Palaeozoic era represented in Edmonton, Province of Alberta, Canada, where reports would indicate the highest endemicity to be encountered in North America. It is interesting to observe at this point in West Virginia, that goiter follows the coal measures more particularly than the limestone formations with which it is commonly associated. This seems to be contrary to the experience of Clark and Pierce of the United States Public Health Service, who made a study of goiter among the school children of eleven counties of West Virginia and nine counties of Virginia.

The association of goiter with certain geologic time would indicate that the disease is not caused by a living organism, but is due to some substance derived from marine animals in past time. The character of this substance is not known, but experiments indicate that it is not retained by a Berkefeld filter and that its goiter-producing property is destroyed by heating to 70° C. It is, of course, possible that goiter is a deficiency disease, that the marine animals of geologic time used up a certain substance in the water that is essential to animal economy. This

theory is severely shaken, however, by the fact that heat evidently destroys the goiter-producing element, but nevertheless it should not be entirely abandoned at the present stage of our knowledge.

Stewart⁷⁸ in commenting on the goiter says, among other things, that the North American Indian was almost exempt from goiter, even though it affected the white men who followed him in the occupation of the same lands. Nor is it less strange that along the Yser River goiter is endemic along the left bank, though not at all so along the right bank. The question is often debated as to why, if water has something to do with the matter, the animals do not suffer. What makes them immune? The answer is, that they are not immune, only they are not investigated with sufficient care, for cases are reported of dogs, cats, goats and sheep being affected. It may be that the goiter-producing substance is a ferment or something similar, and the plan used by Woaker, of England, rested on the giving of hydrofluoric acid, well diluted, thirty drops three times a day. Stewart states that if any patient is put upon boiled water, upon cod-liver oil and upon orange-juice the success of any treatment will become brighter at once.

ETIOLOGY OF EXOPHTHALMIC GOITER. Bergh⁷⁶ is convinced that the tonsils, nose or throat are often the primary source of the infection causing the thyroid derangement responsible for exophthalmic goiter. He has now a record of 11 cases in which treatment was directed to cure the pathologic conditions in the nose and throat, and the exophthalmic goiter subsided. He cites further Salling's report on 97 cases of exophthalmic goiter, in 13 of which the disease had followed immediately on an infectious sore-throat, and he has found 42 on record of a similar preceding infectious disease.

The *relation of emotional shock* is evidenced by the reports of Etienne and Richards⁸⁰ and Milroy.⁸¹ The former state that during the violent bombardment of Nancy from the big guns and aëroplanes, two women, aged twenty-four and thirty-four years, developed exophthalmic goiter, in an acute form, with high blood-pressure. In two other young women the blood-pressure was below normal. Milroy's patient, a young woman in attempting to cross a ravine over a plank fell about ten feet to the ground. She was considerably shaken up and was assisted to her home, where she immediately became ill and showed at once a markedly enlarged thyroid and marked exophthalmos with a very rapid pulse. She had never had any symptoms before, and was apparently in perfect health when she tried to cross the bridge.

An example of *familial exophthalmic goiter* is reported by Souques and Lermovez⁸² who report a family in which among 16 members of three generations there were 7 cases of exophthalmic goiter. The ten-

⁷⁸ Western Medical Times, April, 1919.

⁷⁹ Norsk Magazin for Lægevidenskaben, Christiania, March 1919, No. 3, lxxx; Abstract, Journal of the American Medical Association, 1919, lxxii, 1712.

⁸⁰ Bulletins de la Société Médicale des Hôpitaux, Paris, 1918, xlii, 1196-1199; Abstract, Journal of the American Medical Association, 1919, lxxii, 966.

⁸¹ Journal of the American Medical Association, 1919, lxxiii, 448.

⁸² Revue Neurologique, Paris, 1919, No. 1, 26; Abstract, Journal of the American Medical Association, 1919, lxxii, 798.

dency seemed to have been transmitted by the males. They refer to other instances of familial involvement which have been recorded. In one, 11 of the 16 members of a family developed the disease since 1884.

ACUTE THYROIDITIS. An acute inflammatory lesion of the thyroid is of rare occurrence. This is true, according to Beilby,⁸³ whether the gland is normal or the seat of a preëxisting tumor or enlargement. Among 91 cases operated upon by him for various forms of thyroid lesion, 3 instances of acute suppurative inflammation were encountered. In 2, the infection occurred in normal thyroid glands, and in the third the infection took place in a cystic adenoma of the thyroid.

The infrequency of thyroiditis in the presence of so many infections in the vicinity of the throat is explained by the absence of a direct lymphatic communication. Those cases which are lymphogenous in origin are, according to Beilby, always preceded by a primary focus of infection in the upper portion of the trachea or in the larynx. In the case of infection by the blood stream, which the same author believes is by far the most frequent avenue of entrance in tumors and hypertrophies of the organ, the processes of degeneration present in such lesions predispose to inflammation by a lowering of the local resistance of the tissues.

Beilby reports 3 interesting cases and states with regard to the clinical manifestations, that the symptoms vary accordingly as the thyroiditis is a primary infection or occurs in a preëxisting lesion. In the former, patients usually suffer from chills, malaise and headache, common to all infectious diseases. Pain is felt in the region of the gland, more pronounced on one side, because the process usually begins in a single lobe, often radiating to the ear and side of the neck, lancinating in character and greatly aggravated by extension of the head. As a result, the attitude may be somewhat characteristic, the head bowed and held very rigid. Local swelling is rarely noticed early and is never a marked symptom. Difficulty in breathing and swallowing are present, the degree depending upon the severity of the infection and the extent of gland involvement. The voice may be affected, even absolute aphonia is seen and an irritative cough, with slightly blood-stained expectoration or a true hemoptysis, may be present.

One thing which impressed Beilby was the difficulty experienced in arriving at a correct diagnosis. Acute suppurative infections should not be confused with the milder forms of inflammation which are often seen during many of the acute infectious diseases, relatively most often after typhoid fever in which the symptoms are of a much milder nature and which seldom require surgical intervention.

Because of the anatomical relationships, inflammatory processes arising within the substance of the gland produce swelling which affects first and most markedly the trachea and esophagus which it surrounds on three sides. The capsule being but slightly elastic, under the influence of a sudden increase in the volume of gland, the lateral lobes are approximated, exerting a side to side pressure upon the trachea and esophagus.

⁸³ Albany Medical Annals, June, 1919.

Thus the earliest symptoms, with the exception of pain, are those of tracheal and esophageal stenosis. It is Beilby's experience that the cause of such stenosis is liable to be sought for within the throat rather than as due to compression from without. A symptom, however, which is pathognomonic is the stony-hardness of the gland elicited on palpation. No other condition imparts a similar feeling, unless it be carcinoma. Here the history and the absence of fever should make differentiation of these conditions easy.

In Beilby's patient presenting an infection occurring in a preëxisting thyroid lesion, the symptoms of the local inflammatory process were obscured by the general infection from which the patient was suffering. The symptoms of the acute infection had not completely subsided when the local process in the neck began and it was thought that the patient was suffering from a relapse of the influenza. Only after the local process had developed to a considerable degree was the exact condition recognized. The severity of the pressure symptoms in cases of this type depends largely on the location of the tumor or cyst which is the seat of the infection. In other words, if the preëxisting lesion already causes pressure on the trachea and the structures of the neck, with the advent of an infection this symptom will be greatly increased. If, on the other hand, we have to deal with a tumor or cyst that is well outside the main sheath of the gland capsule, pressure symptoms will be relatively slight.

The treatment of acute thyroiditis and of suppurative processes in preëxisting thyroid lesions is, *per se*, like that of other local inflammations. Because a general anesthetic might prove both difficult and dangerous, operative procedure should be done under local anesthesia. Care should be taken that every collection of pus is reached, and whe drainage of more than one lobe of the gland is necessary, it is usually possible to establish this through a single opening in the capsule. No extensive surgical measures, such as partial excision of the gland or removal of tumors or cysts, should be undertaken in the presence of such serious infection. These procedures, when deemed necessary, should be reserved for subsequent operation.

A case reported by Caliceti²⁴ is of interest in connection with Beilby's report. The patient developed a thyroid abscess secondary to an otitis media and mastoiditis. There was no sinus thrombosis. Following shortly upon the development of the thyroiditis the symptoms presented certain features of the clinical picture of exophthalmic goiter. The abscess was incised and the pus from it as well as from the mastoid showed streptococci. Following incision and drainage the exophthalmos and other symptoms cleared up. Höpfner²⁵ also has reported a case of acute suppurative thyroiditis.

TUBERCULOSIS OF THE THYROID. In 7 cases reported by Plummer and Broders²⁶ the diagnosis of tuberculosis of the thyroid was made following thyroidectomy. Three of the patients had symptoms, physical findings, thyroid signs, and basal metabolic rates typical of high grade

²⁴ Policlinico, Rome, 1918, xxv, 1219.

²⁵ Berliner klinische Wehnschr., 1919, lvi, 944.

²⁶ Journal of the American Medical Association, 1919, lxxiii, 1464.

Graves's disease. Microscopic sections showed the usual picture of exophthalmic goiter. Two patients had mild hyperthyroidism, one probably had hyperthyroidism and one had no symptoms indicative of exophthalmic goiter. Four patients had small, firm nodular glands suggesting malignant disease. The microscopic examination of three of these disclosed a great deal of gland destruction with slight parenchymatous hypertrophy. The last patient had no symptoms of hyperthyroidism associated with very extensive destruction of the parenchymal gland. The feature of this study is that in 6 patients the evidences of hyperthyroidism were definite; the toxic symptoms being less severe the greater the tuberculous involvement. Plummer and Broders were unable to find anything indicative of tuberculosis preceding the hyperthyroidism. One patient developed myxedema following operation.

HYPERTHYROIDISM AND SOLDIER'S HEART. A voluminous literature has appeared during the past several years on a syndrome, the original description of which we owe to Da Costa, and variously termed soldier's heart, neurocirculatory asthenia, effort syndrome, cardiovascular defective, irritable heart, D. A. H. (disordered action of the heart), etc. In reviewing the literature on soldier's heart one finds a large group of etiological factors described. Carroll⁸⁷ states that from this array of opinion we are offered three etiological factors: (1) Hyperthyroidism, (2) constitutional instability and (3) infection. It is entirely probable that several of these factors act together in the production of the neurocirculatory asthenia. It is not within the province of these columns to discuss soldier's heart at length, but to refer principally to that phase of it related to the thyroid gland. In his article, Carroll states that the theory that the disease is due to thyroid disturbance is supported by such sound clinical judgment as Harlow Brooks in America and Sir James Barr in England, both of whom described in the picture palpable thyroid enlargement as well as the clinical phenomena common to hyperthyroidism. Many other observers agree with this view. On the other hand, Lewis considers infection the predominant etiological factor in the syndrome, and his school dispose of the theory of hyperthyroidism after failure to demonstrate a more or less constant palpable thyroid enlargement. Carroll believes this inadequate ground for dismissal of the theory: (1) Because the personal factor in deciding the presence or absence of thyroid enlargement is a very considerable one, and (2) because no one has, to his knowledge, noted palpable thyroid enlargement as a more or less constant finding among the troops in France; yet McNee and Dunn found the average weight of the thyroid from 65 men killed in action 26.7 grams, a figure notably above the normal for civilian males of corresponding age.

It is well known among students of thyroid disease that in some very severe cases of thyrotoxicosis the thyroid gland is not definitely palpable, or at most not more so than in many presumably healthy persons. Carroll states that when we leave the debatable ground of thyroid enlargement and approach the symptomatology of the two conditions

⁸⁷ American Journal of Medical Sciences, 1919, clviii, 35.

we see a strong justification for the supporters of the hyperthyroidism theory.

To quote Carroll: "There is a striking similarity in the clinical phenomena of the two conditions, and if we disregard the signs in Basedow's disease known to be due to stimulation of the superior cervical, the phenomena are identical. These phenomena are attributable to a hyperirritability of the opposing sets of fibers in the autonomic nervous system, and include the following:

- (a) Epiphora Loewi 0.5 phenomena; excess or lack of saliva.
- (b) Asthmatic dyspnea or tachypnea.
- (c) Tachycardia, pulsus irregularis and respiratorius, vasomotor angina; subjective palpitation; transitory change in blood-pressure; vasomotor symptoms, especially transitory erythema and dermatographism.
- (d) Gastropasm, pylorospasm, gastric hyperacidity, spastic constipation; unmotive watery movements, painless diarrhea, unmotive vomiting; pollakiuria, polyuria, oliguria; profuse sweating; all domain under autonomic control.

There is a growing opinion among students of Graves's disease that we have too long been concentrating our attention on the cardinal triad and too little considering the other phenomena of the disease, and that we have, in the words of Pottenger, been confusing several different entities in our cases of Graves's disease."

Carroll further states that the type of Eppinger and Hess, described as sympatheticotonic and characterized by marked exophthalmos, epinephrin mydriasis, Möbius' sign, dry eyes, no sweating, no diarrhea, is a definite entity. These phenomena are attributable to stimulation of the sympathetic fibers whose motor cells lie in the cervical sympathetic, and there is a striking absence of phenomena which lead to the parasympathetic system. For the firm foundation to the pathogenesis of the type, we owe much to the researches of the pathological department of the Mayo school, as the following extract from the reports of Wilson and Durant would attest. It would appear from our examination by the method detailed that definite histological changes do occur in the cervical sympathetic ganglia in hyperplastic toxic (exophthalmic) goiter, and, further, these histological changes consist of various states of degeneration, *viz.*: (a) Hyperchromatization, (b) hyperpigmentation, (c) chromatolysis and (d) atrophy of the nerve cells. All these are but successive steps in degeneration, which, if uninterrupted, proceed to the complete destruction of the ganglion cells affected. Not all of the ganglion cells in any of the ganglia examined were so completely destroyed as to render impossible their return to normal under favorable conditions. There is some evidence that in ganglia, from cases clinically improved, some of the cells have partially or wholly recovered.

After separating cases of this type from the syndrome of Graves's disease, we have left a greater group in which the symptomatology is attributable, in great part, to tissues supplied by the autonomic nervous system. Particularly is this so in cases of hyperthyroidism without frank exophthalmos. In such cases, if we accept the thyroid increase,

all the phenomena may be attributed to hyperactivity of the greater vagus system. It does not appear possible to us that hypersecretion of the thyroid autocoid can explain these striking differences in clinical pictures.

At the end of his paper, Carroll comes to six conclusions which are deserving of repetition:

1. That some types of hyperthyroidism are analogous to the entity neurocirculatory asthenia and their pathogenesis is probably identical, the phenomena being attributable to a hyperexcitability of the opposing sets of fibers of the autonomic nervous system.

2. That in both conditions the syndrome develops in individuals in whom there is a hyperirritability of one or other sets of fibers in the autonomic system. Hence, constitutional predisposition due to inherited sympathetic or vagotonic instability is a factor in the causation on a sound basis.

3. That nervous and emotional strain is the immediate cause, precipitating the syndrome in susceptible individuals.

4. That in the cause of susceptibility (acquired instability of the autonomic nervous system) infection plays a predominant role, and the susceptibility in such cases may be accepted as indicating a chronicity of the infection with constant or frequent outpourings into the blood of the infective agent.

5. That there is a certain rationale for believing that this instability in the autonomic nervous system lies in the element of anaphylaxis in disease in the predilection of anaphylatoxin for the parasympathetic system.

6. That there is some evidence that deficiencies of calcium in the diet may have played a part in the causation of some of the phenomena and that the higher plane of inorganic metabolism in the organism may have shared with adrenin increase the responsibility in causation of the thyroid hyperplasia and hyperthyroidism among the soldiers.

Warfield,⁸⁸ in an article entitled *The Cardiovascular Defective*, reports an experience at the Jefferson Barracks, Missouri. Among a group of men who presented tachycardia they were able to sort the cases into several categories. Some were frankly tuberculous and were at once rejected. Some were cases of definite hyperthyroidism, etc., and were at once rejected. There were others which could not be so summarily dealt with. These were cases in which tachycardia or a very labile pulse was found and in which no definite lesion of any kind could be discovered. These were sent to the hospital for further observation and examination.

Warfield tabulates these observations according as the cases were disposed of at the examining barracks and in the hospital as follows:

Disposition of Cases at Examining Barracks. Sixty cases (37.0 per cent.) diagnosed hyperthyroidism, rejected; 47 cases (29.0 per cent.) diagnosed pulmonary tuberculosis, rejected; 52 cases (32.0 per cent.) diagnosed irritable heart, rejected; 2 cases (1.2 per cent.) diagnosed

⁸⁸ American Journal of the Medical Sciences, 1919, clviii, 165.

cirrhosis of the liver, rejected; 1 case (0.8 per cent.) diagnosed bronchial asthma, rejected.

Disposition of Cases Observed in Hospital. Forty cases (29.6 per cent.) no lesion found, normal, accepted; 17 cases (12.6 per cent.) diagnosed hyperthyroidism, rejected; 47 cases (34.8 per cent.) diagnosed pulmonary tuberculosis, rejected; 29 cases (21.5 per cent.) diagnosed irritable heart, rejected; 2 cases (1.5 per cent.) diagnosed cirrhosis of the liver, rejected.

In discussing the disposition of these cases, Warfield comments upon the frequency of pulmonary tuberculosis and hyperthyroidism which compose the greater portion of the two groups. The symptoms complained of by the men were so similar in the various groups that separation was often difficult.

In the summary of his experience, Warfield has this to say in a general way with regard to the cardiovascular defective, which knowledge will prove of value to us in civil life, namely, that there is a class of young men of usually healthy appearance who nevertheless suffer from a group of symptoms following mild exercise, characterized by breathlessness, precordial pain, dizziness, palpitation and exhaustion. There also may be headache, sleeplessness, cold, clammy hands and feet and profuse sweating. These men might never have been discovered except for the army draft, which caused thousands of young men to be examined physically. These men have no complaints, as a rule, which lead them to seek medical advice. They find that they are better able to make a living at light or sedentary work than at hard work, so drift into the lighter occupations. The majority are surprised when told that there is something really the matter with them, although they have recognized the fact that they cannot take the violent exercise which other men of their acquaintance can take. A certain number are taken by their parents to a doctor, who may diagnose heart disease or neurasthenia.

There is no common etiological factor among the true cardiovascular defectives—no cause can be found except a constitutional inferiority, a poor quality of tissue which must be supposed to account for the syndrome. Among others, certain chronic diseases or the result of severe acute illnesses are responsible for the syndrome.

When there is a definite pathological basis, such as pulmonary tuberculosis or chronic focal infection, etc., cure of the disease causes the effort syndrome to disappear. Cases resulting from infectious disease or based upon constitutional inferiority do not improve in our experience.

Exercise was valuable in determining the fitness of the men for military duty and in giving data in the diagnosis of certain cases suspected of being tuberculosis.

THE DIAGNOSIS OF THYROID DISTURBANCE. The clinical study of thyroid disease has demonstrated two present-day requirements: (1) The need for a more accurate method of differentiating the border-line cases, and (2) the need for a test or tests to estimate the degree of thyrotoxicosis. Practically all cases of hyperthyroidism at the outset present border-line symptoms. These symptoms are more or less vague, and may be either constant or intermittent and consist for the most part

of tachycardia, nervousness and hyperidrosis, and a trifle later of varying grades of debility and digestive disorders, and perhaps a little later still, mild, irregular febrile disturbances. These symptoms of toxemia are not particularly significant and may easily be due to any one of several different causes, especially chronic infections. As a means of differentiation, Goetsch has devised what is known as the Epinephrin Hypersensitive Test. He presented a paper before the Pennsylvania State Medical Society in September, 1919, in which he stated that he had data concerning the value of this test in 300 cases of thyroid disease and approximately 100 conditions simulating in many respects hyperthyroidism. The test depends upon the fact that in hyperthyroidism there is an increased constitutional sensitiveness to epinephrin, and in states of hypothyroidism there is an increased tolerance for epinephrin hypodermically administered. In a so-called positive reaction there is usually an early rise in systolic blood-pressure and a fall in diastolic blood-pressure. In a very mild reaction the fall in diastolic pressure may occur alone. Together with these changes one sees an exaggeration of the clinical picture, especially the nervous manifestations.

In another communication Nicholson and Goetsch⁸⁹ discuss the use of the test in the differential diagnosis of hyperthyroidism and early pulmonary tuberculosis. These two conditions have much in common in their symptomatology. Thus we find patients in whom fatigue, asthenia, loss of strength, loss of weight, nervousness in varying degrees, tachycardia, vasomotor instability and possibly slight elevation of temperature would make one suspicious of tuberculosis, but in whom the physical signs, laboratory and x-ray findings are insufficient for a positive diagnosis.

An equally difficult problem, as Nicholson and Goetsch state, is presented by another group of cases in which there is a tuberculous lesion definitely demonstrable by physical signs and x-ray, which, however, after a sufficient length of treatment may, or may not, show retrogression and which is still accompanied by symptoms of rapid pulse, fatigue, and possibly slight elevation of temperature. Here it is questionable whether the symptoms can be attributed to the tuberculous lesion. Especially is this so if, after six months' rest cure, the pulmonary condition shows improvement, both from physical signs and x-ray findings.

Regarding both of these groups, the question naturally arises: Are these symptoms referable to the tuberculous lesion, are they a residual syndrome of previously active tuberculosis, or are they due to an entirely different cause?

In the performance of the test, Goetsch describes the following: Two readings are taken, at five-minute intervals, of the blood-pressure, systolic and diastolic, pulse-rate, and respiration. A note is made of the subjective and objective condition of the patient. This includes the state of the subjective nervous manifestations, the throbbing, heat and cold sensations, asthenia, and the objective signs, such as pallor or flushing of the hands and face, the size of the pupils, throbbing of the

⁸⁹ American Review of Tuberculosis, 1919, iii, 109; Canadian Medical Association Journal, 1919, ix, 481.

neck vessels and precordium, tremor, temperature of the hands and feet, perspiration, and any other characteristic signs or symptoms noticed. These signs are all noted previous to the injection of the adrenalin so that comparison may be made after the injection.

A hypodermic injection of 7.5 minims of the commercial 1 to 1000 solution of adrenalin chloride into the deltoid region is administered subcutaneously. Readings are then made every two and one-half minutes for ten minutes, then every five minutes up to one hour, and then every ten minutes for half an hour or longer. At the end of one and a half hours the reaction has usually entirely passed off, sometimes earlier. The repeated early readings are made in order not to miss certain reactions on the part of the pulse and blood-pressure that may come on in less than five minutes after the injection is made. This is particularly true of cases of active hyperthyroidism.

In a positive reaction there is usually an early rise in blood-pressure and pulse of over ten points at least; there may be a rise of as much as fifty points or even more. In the course of thirty to thirty-five minutes there is a moderate fall, then a second slight secondary rise, then a second fall to the normal in about one and one-half hours. Along with these one sees an exaggeration of the clinical picture of hyperthyroidism brought out, especially the nervous manifestations. The particular symptoms of which the patient has complained are usually increased, and in addition there are brought out many symptoms which have been latent. Thus it is not uncommon to have extrasystoles brought out, after the injections of the adrenalin. The patient is usually aware of them and may tell one that she had felt this same thing a year or two previously, at which time the symptoms of the disease were more active.

The following may all or in part be found: Increased tremor, apprehension, throbbing, asthenia, and in fact an increase of any of the symptoms of which the patient may have complained. Vasomotor changes may be present, namely, an early pallor of the face, lips and fingers, due to vasoconstriction, to be followed in fifteen to thirty minutes by a stage of vasodilation with flushing and sweating. There may be a slight rise of temperature and a slight diuresis.

In order to interpret a test as positive, Nicholson and Goetsch have regarded it as necessary to have a majority of these signs and symptoms definitely brought out or increased. Thus there is at times, a considerable increase of pulse-rate without much increase in systolic blood-pressure, but with a considerable increase or exacerbation of the objective signs and symptoms; or there may be an increase of ten points in the pulse and blood-pressure and a moderate increase of the symptoms and signs; or again, there may be only slight changes in pulse and blood-pressure and considerable change in signs and symptoms. These may be regarded as positive. In a word, then, one must consider the entire clinical picture produced in order to gain a correct interpretation, just as in the disease itself one cannot expect every one of the characteristic signs and symptoms to be present in order to make a diagnosis.

Nicholson and Goetsch present the results obtained in the study of 40 cases which include three groups. In the first group there were 18

in whom clinical tuberculosis was questionable. Ten of these reacted positively to the adrenalin test and 8 negatively. In the second group there were 16 with inactive clinical tuberculosis and of this number 9 showed a positive response to the adrenalin test. The hyperthyroidism in these cases was a complicating feature. In the third group, consisting of 6 cases of moderately active tuberculosis, the adrenalin test was negative in all. The technic of the test is simple and would seem to recommend itself to those who come in contact with many tuberculous patients, (1) to enable them to differentiate early tuberculosis from hyperthyroidism and (2) to pick out those tuberculous patients in whom the symptoms cannot be accounted for by the amount of tuberculosis either active or inactive, but may be due to thyroid over-function.

Bernard⁹⁰ considers the test of value in differentiating the group of cases in which the excessive functioning of the thyroid is responsible for conditions labeled psychoneuroses, psychasthenia and neurasthenia, without any appreciable ocular, vasomotor or cardiac symptoms. On the other hand, Boas⁹¹ performed the Goetsch test in a series of 21 consecutive cases of neurocirculatory asthenia and came to the conclusion that it was impossible to state whether or not a particular case was sensitive or not.

The *second* pressing need in the clinical study of patients with thyroid disturbance is for a test to estimate more accurately the degree of thyrotoxicosis than the simple consideration of the subjective clinical manifestations will allow. The recent simplification of the basal metabolism and alimentary hyperglycemia tests have been very satisfactory, and, as McCaskey⁹² points out, marks an epoch in the study of hyperthyroidism. He reviews these two tests and their practical application.

The *basal metabolism* is by far the more important of these two methods. By basal metabolism is meant that minimal quantity of metabolic change essential to the neuromuscular and secretory phenomena of what might be called the basal and necessarily continuous organic functions—respiration, circulation and secretion. Rest and food abstinence approximately eliminate all other metabolic activities. It has been well known since the classical work of Friedrich Müller and Magnus-Levy, about twenty-five years ago, that one of the most characteristic phenomena of hyperthyroidism was an increase in general metabolism, while hypothyroidism produced exactly the opposite result. This, of course, depends on the regulatory action of the thyroid secretion on metabolic processes, which apparently bear a direct relationship to each other.

Since that time, as McCaskey points out further, a great deal of work has been done by various investigators in confirmation and elaboration of these facts. This work has for the most part been done in well equipped hospitals and institutions with large and complicated apparatus requiring, for instance, the services of an expert gas analyst and, therefore, not at all practical for general clinical purposes. Taking advantage of the portable and comparatively inexpensive apparatus of Benedict⁹³

⁹⁰ Progrès Médicale, Paris, 1919, xxxiv, 19.

⁹¹ Archives of Internal Medicine, October, 24, 1919.

⁹² Journal of the American Medical Association, 1919, lxxiii, 243.

⁹³ Boston Medical and Surgical Journal, 1918, clxxviii, 667.

which can be operated in any small hospital or office by any one reasonably familiar with laboratory technic. The introduction of this apparatus, which can be placed in the corner of any convenient room, the only accessory being a couch, places the entire medical profession under additional obligation to this distinguished investigator.

The estimation of metabolism by measuring the units of heat production is made possible by the application of Rubner's law, that it is proportional to the body surface from which, with some exceptions, all heat not actually expended in energy production is radiated. The basis of this law is, of course, the universally accepted laws of the conservation and transmutation of energy and the radiation of heat. The chemical forces of the body, which represent the sum total of metabolism, are transmuted into heat, the excess of which over body requirements is radiated from the surface. The standard chosen is the number of calories per square meter of body surface per hour. The body surface is determined very simply by what is known as the "height-weight formula" based on two factors, namely, the height in centimeters and the weight in kilograms. By the use of the chart, plotted from this formula, as worked out by DuBois²⁴ and the two factors of weight and height, the body surface expressed in square meters is instantly read without any calculation whatever. In the determination of oxygen consumption the patient is made to fast overnight and then to lie on a couch for thirty minutes or more to get rid of the respirable products of all metabolism other than basal, resulting especially from the voluntary musculature. The patient breathes through the mouth-piece connected with the open air for a few minutes in order to establish quiet normal breathing, after which the breathing is in and out of a spirometer bell. The oxygen and nitrogen only are rebreathed, for the carbonic acid is entirely removed from the expired air by being passed through an absorbent (soda-lime). The scale on the side of the spirometer bell is read at the beginning of the observation and again at the end of whatever period is chosen (usually ten minutes), both observations being made at the same point of time; that is, at the end of expiration. Since the carbonic acid gas has disappeared and the nitrogen is not influenced, the difference in the readings on the spirometer scale accurately represent the amount of oxygen consumed. The volume of gas is then corrected for barometric pressure and thermometer readings in order to bring it to the standard of sea-level and zero centigrade. This corrected volume, which is obtained by the use of logarithms, but which could undoubtedly be determined on the percentage basis with sufficient accuracy for all clinical purposes, is used as the basis of the indirect calorimetric calculation. Each liter of oxygen gas, with the above-mentioned corrections, represents 4825 calories of heat. From this the calories are calculated for one hour. By dividing the calories per hour by the body surface, determined as above indicated, we have the final result of calories per square meter per hour.

The number of calories per square meter of body surface per hour

²⁴ Archives of Internal Medicine, 1916, xvii, 863.

varies normally with sex and age and perhaps other physiologic conditions. By the DuBois or "height-weight formula" the average figure for men is 39.7; for women 36.9. In pathologic conditions and conspicuously in disturbances of thyroid secretion, these figures are subject to numerous variations. In HYPERTHYROIDISM the increase is striking; very mild cases, including the border-line group, and frank cases of thyrotoxicosis in the quiescent state, may show an increase up to 30 per cent.; mild cases, 30 to 50 per cent.; severe cases, 50 to 75 per cent., and very severe cases, 75 to 100 per cent. or more, following the classification of DuBois excepting that the "mild" cases of DuBois (below 50 per cent. increase of basal metabolism) are subdivided into "mild" and "very mild" to correspond with his "severe" and "very severe" cases above 50 per cent. increase.

In HYPOTHYROIDISM there is a definite reduction in the basal metabolism below that of normal individuals of the same age and sex. This has been recently demonstrated by Means and Aub,* who studied 3 untreated cases of myxedema. Similarly the basal metabolism in an untreated cretin and in a case of cachexia strumipriva showed a marked reduction. In the latter case the fall in metabolism antedated the clinical appearance of hypothyroidism. In a case of carcinoma of the thyroid a moderate reduction in basal metabolism was found, both before and after thyroidectomy, without clinical evidence of hypothyroidism. The metabolism of all patients studied during thyroid therapy was readily brought to normal or above by the administration of thyroid extract. The authors emphasize that the determination of the basal metabolism forms a sound and convenient method for governing the dosage of thyroid preparations in cases of hypothyroidism, and furnishes a far better guide in this respect than does the clinical picture. It is also of value as a means of differential diagnosis in obscure cases. In the treatment of hypothyroidism, doses of from 3 to 4 grains of thyroid extract, daily, should be ample to bring the metabolism to normal in two or three weeks, and doses of from 1 to 2 grains daily should usually be sufficient to keep it here. Cases of cachexia strumipriva may require larger maintenance doses than those of spontaneous hypothyroidism.

McCaskey sounds the warning that it is important to remember that like all physiologic processes in either normal or pathologic condition, basal metabolism is subject to marked variations. This variation, however, offers no greater difficulties than in other procedures, such as the test for albuminuria, glycosuria, the Wassermann test, variations in temperature, etc. When properly correlated with the general clinical syndrome it may be regarded as one of the most reliable and scientifically accurate aids available in any field of diagnosis, and is of inestimable value not only in establishing the diagnosis but in studying the clinical course of this disease.

Alimentary Hyperglycemia in hyperthyroidism has been known since the work of Tachau in 1911. Until recently, as McCaskey points out, the methods of blood analysis were too cumbersome for clinical use. Now by the newer and simplified blood-sugar methods such deter-

* Archives of Internal Medicine, 1919, xxiv, 404.

minations are available. McCaskey uses the method described by Denis, Aub and Minot,²⁸ which can be completed in little more than two hours, and can be used in combination with the basal metabolism, the entire procedure requiring less than three hours. He describes the test and its interpretation as follows:

The fasting blood is first taken; then the patient is given 100 gm. of glucose. In one hour a second blood specimen is taken, and in another hour, a third, which by this technic completes the blood study. The urine also is examined at the end of the first and second hours, and may be examined for several hours longer, although the glycosuria is a question involving the renal glucose threshold rather than the thyroid question.

Under normal conditions, in the average person in the fasting state, 100 gm. of glucose does not produce a hyperglycemia lasting as long as one hour. At least this was the result in 14 of McCaskey's cases, and in 16 of those recorded by Denis, Aub and Minot. Hamman and Hirschman, however, obtained an alimentary hyperglycemia in normal persons following 100 gm. of glucose, the crest of the wave occurring in from twenty to forty minutes, but still remaining to some extent at the end of one hour or longer. In view of these facts, it must be regarded as possible that a transient hyperglycemia occurred during the first hour in observations made according to the methods used in this paper, disappearing at the end of the first hour.

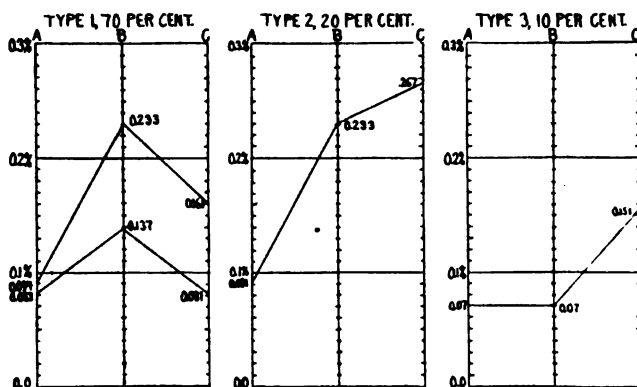


FIG. 73.—Sample curves illustrating types of alimentary hyperglycemia in thirty-one cases of hyperthyroidism: A, blood sugar fasting; B, blood sugar one hour after 100 gm. of glucose; C, blood sugar two hours after 100 gm. of glucose.

Whatever may be the fact in regard to normal persons, there seems to be no question that in hyperthyroidism after the ingestion of 100 gm. of glucose there is almost invariably a marked hyperglycemia, the crest of the wave occurring at the end of the first hour, or at least recognized then by this method, with a sharp fall in 70 per cent. of the cases by the end of the second hour. This curve was found in 22 of 31 cases (about 70 per cent.) of hyperthyroidism. In 6 cases (20 per cent.), the hyperglycemia continued to rise until the end of the second hour. In 3 cases only (or about 10 per cent.) the hyperglycemia did not occur until the end of the second hour. These curves are well shown in Fig. 73.

²⁸ Archives of Internal Medicine, 1917, xx, 964.

The delayed hyperglycemia shown by the curves represented in Types 2 and 3 is probably the result of retarded absorption due to gastrointestinal conditions. It suggests the possibility of a belated hyperglycemia occurring in some of the cases in which it does not appear within the two-hour period. This is apparently a valid criticism of this technic. McCaskey's answer is that in the 45 cases of actual or suspected hyperthyroidism forming the basis of this section of this paper, there were 13 which did not show a hyperglycemia within two hours, and in none of these could the diagnosis of hyperthyroidism be established on other grounds, although two or three still look suspicious.

In practically every case in which the diagnosis of hyperthyroidism seemed to be reasonably well established on other grounds, including the basal metabolism observations, a definite hyperglycemia occurred not later than the second hour, and in 90 per cent. of the cases within the first hour. As a routine procedure, therefore, he believes that the two-hour period is sufficient.

In doubtful cases, and especially when the determination of basal metabolism cannot be made, the alimentary hyperglycemia test, as above outlined, may prove to be of considerable value. Of course, diabetes, alcoholism, etc., must be excluded.

In the discussion of McCaskey's paper, attention was called to the interdependence of the various endocrine glands and to the fact of their influence on carbohydrate metabolism. Thus, Barker⁹⁷ stated that "Whether the increased nasal metabolism and the hyperglycemia are due to the direct action of thyroid products, or are indirect results of thyroid activity, remains to be seen. We must think of the influence of the thyroid products on the cell metabolism all over the body, on the one hand; and, on the other, we must keep in mind the influence of the thyroid products on the activity of the other endocrine glands. I would mention one relationship, especially that of the thyroid to the suprarenal gland. Many of the phenomena that we speak of as hyperthyroidism may, in reality, be due to hypersuprarenalism, and it may be that some of our clinical tests for thyroid activity measure directly rather the suprarenal activity, and only indirectly the thyroid influence. I simply point out some of the difficulties, though I think that the tests are really valuable in internal medicine and I hope that they will be much more employed, and that we may come to some agreement as to what the results they yield may mean."

Dr. Janney, continuing the discussion, stated that the value of the blood-sugar tolerance in diagnosis is problematic. He and others have found abnormally high blood-sugar curves in various conditions, for example, pituitary disorders, Addison's disease, and other less clearly defined endocrinopathies. He stated that it was unfortunate, therefore, that this test, though frequently indicating an abnormal carbohydrate metabolism in hyperthyroidism, is by no means pathognomonic of that condition. He advised that the technic of the blood-sugar test should be standardized in the future so that more definite and accurate results

⁹⁷ Journal of the American Medical Association, 1919, lxxiii, 247.

may be obtained. He used 1.50 gm. of sugar dissolved in 2.5 c.c. of water per kilogram of the patient's weight. The blood-sugar is determined one and two hours afterward and the normal level is found to be 0.12 to 0.14 per cent. without glycosuria.

Lueders⁹⁸ discusses the value of the laboratory in the diagnosis of early hyperthyroidism and concludes that it affords the most reliable means toward the recognition of the disease. The sugar tolerance test in his opinion is important in the detection of border-line cases. The epinephrin test did not prove, in the study of cardiac neurosis, diagnostic of hyperthyroidism, but rather seemed to be an index of the sensitization of the sympathetic system. Its value as a diagnostic test is increased when associated with blood-sugar tolerance tests. Creatinuria, likewise, when taken in conjunction with the other tests, seemed of value in the diagnosis of the thyroid disorder group.

INTRATHORACIC GOITER WITH THYROTOXICOSIS. A true intrathoracic goiter, or one lying entirely within the thorax and without visible signs of enlargement of the gland in the neck, occurs only in from 6 to 7 per cent. of all goiters, according to Leiner,⁹⁹ who reports such a case showing a thyrotoxicosis. Goiters become intrathoracic from a number of causes, the basis of which is gravity. Coughing, arduous work requiring extension and flexion of the neck, and labor are adjuvants to gravity. Leiner's patient presented hyperthyroidism with the intrathoracic enlargement. She was a Russian woman, aged thirty-four years. She came under observation in 1916, at which time she showed a marked exophthalmos, a von Graefe, a pulse of 95, and an enlarged thyroid which showed in her neck. A soft systolic murmur was heard at the apex. The patient complained very little of any subjective disturbances, with the exception of feeling somewhat nervous. About one year later she showed objectively a markedly hypertrophied thyroid, marked exophthalmos, a pulse of 140, tremor and other symptoms.

In January, 1919, she was seen again, at which time her complaint was marked asthenia, a choking sensation in the throat, difficulty in breathing, and cardiac palpitation. The patient seemed well nourished, and of large build. Her hair was abundant, palms were moist, glands not palpable, no pigmentation, teeth normal. Her eyes showed some exophthalmos, but not so marked as previously. A double von Graefe was present, as well as a fine tremor of her fingers. Upon examining her neck, the thyroid gland could not be palpated, but in its place there was a baggy mass of loose distended fatty tissue. Pulse, when sitting, was 108; blood-pressure: systolic, 138 and diastolic 80. Her heart showed a systolic murmur, both at the apex and at the base. Percussion over the sternum revealed a small area of dullness. There was an impact against the finger, when it was hooked behind the episternal notch when the patient swallowed. However, it was noticed that this could not be elicited after she had repeated the process several times. A diagnosis was made of an intrathoracic goiter with symptoms of hyperthyroidism. A fluoroscopic examination showed a shadow in the upper portion of

⁹⁸ Archives of Internal Medicine, 1919.

⁹⁹ New York Medical Record, 1919.

the mediastinum. This shadow was distinct in outline, and rounded and triangular in shape. The base of the triangle lies upward. There was no displacement of the trachea or esophagus.

In discussing the case, Leiner states that there are two problems: (1) The hyperthyroidism and (2) the intrathoracic goiter. The former are, on the whole, milder than when first seen three years ago. The latter being of small size, the pressure symptoms were not urgent. Surgical intervention was not considered, in view of the improvement in her condition which the author attributes to thymus therapy. She was given 5 grains of thymus extract three times a day. The exact status of thymus therapy has not been determined, but we do know that in certain cases of thyroid enlargement there is hyperplasia of the thymus. Whether this may be considered a compensatory activity or otherwise, the favorable clinical experience of Lenier is of interest.

THE BLOOD PICTURE IN EXOPHTHALMIC GOITER. Although some writers still maintain that anemia of the chlorotic type is a characteristic of exophthalmic goiter, this is not borne out by the findings of Plummer¹⁰⁰ who reports a study of the blood counts in 578 patients who were examined at the Mayo Clinic. The count from the entire group averaged as follows:

Hemoglobin	83.10 per cent.
Erythrocytes	4,790,000
Leukocytes	6973.60
Polymorphonuclears (relative)	58.30 "
Polymorphonuclears (absolute)	4065.60
Small lymphocytes (relative)	34.80 "
Small lymphocytes (absolute)	2426.70
Large lymphocytes	4.40 "
Transitionals	1.10 "
Eosinophiles	1.60 "
Basophiles	0.49 "

It will be seen that the hemoglobin, red cell and white cell counts are approximately normal. The hemoglobin was below 70 per cent. in only 13, or 2.2 per cent., of the 578 patients. Considering the degree of organ degeneration frequently present in this disease, there are surprisingly few patients with a low grade anemia.

In contrast to Kocher's findings of a leukopenia averaging 5000 leukocytes in 106 cases, Plummer's average count was 6973 leukocytes among 578 patients. The differential count shows a relative and an absolute mononucleosis and a percentage decrease in the polynuclear neutrophiles. Plummer states with regard to the leukocytes, that in patients with exophthalmic goiter there is a wider variation probably dependent on the neutrophiles than among normal counts, and while there are more counts showing a decrease in leukocytes there is an equally large number showing a slight increase. When a leukopenia is present, the decrease takes place at the expense of the neutrophiles and conversely. The eosinophiles show some variation, but the total averages give no increase.

In the study of the relation of the blood-count to mortality, it was found that the relative lymphocyte count was a few points under the average, but not sufficiently so to be of value in prognosis. He concludes that the differential count has a very limited value in diagnosis, except for a polynuclear leukocytosis immediately following operation, and during tonsillitis and other infections. Plummer has been unable to determine any factor which influences the blood-picture and concludes that future research will probably determine the value of the blood examinations when combined with a study of the metabolic rates and the blood-pressures.

THE X-RAY TREATMENT OF THYROTOXICOSIS. The value of the x-ray in the treatment of toxic and non-toxic goiter has been frequently reported during the last decade. Pfahler, in 1916, collected 76 reports of its use in exophthalmic goiter. During the past year Holmes and Merrill¹⁰¹ have reported the experience of the last five years at the Massachusetts General Hospital in the x-ray treatment of 262 patients with thyrotoxicosis. The results obtained have been sufficiently encouraging to warrant a more general application of this form of therapy.

Holmes and Merrill arrange the cases reported in four groups: 1. Patients in whom very definite benefit ensued, apparently as the result of the treatment, and are clinically well. In this group there were 34 patients. Two of the patients had been operated on without complete relief of symptoms. In some of the cases exophthalmos persists, but the patients are free from symptoms of thyrotoxicosis. The number of treatments received by each patient ranged from 3 to 13, the average number being about 7. The greatest duration of treatment was thirty months, and the shortest four, while the average time was eight months. When a record of the metabolism was made, it showed a sharp drop in most cases. This was true of the pulse also. But in some who never had a high metabolism the pulse remained high, and in these there is some doubt in regard to the diagnosis. In typical thyrotoxicosis the pulse usually follows the metabolism. Seventeen of the number showed a gain in weight; six a loss of weight, and in the remainder the records were incomplete.

2. Patients in whom there was definite improvement but who still manifested some evidence of disease. In this group there were 68 patients. In a few the diagnosis may have been incorrect, but all of the cases were referred from the medical department for treatment for hyperthyroidism. The opinion as to the result of the treatment is based on a study of the clinical records, and the statement of the patient at the time of the last visit. They were under observation for from three months to two years and a half. The average time, however, was rather less than in Group 1. The average number of treatments received was also less.

3. Patients in whom there was no change under treatment or who became definitely worse. In this group there were 14 patients. In the case of 2 of the patients the diagnosis was probably incorrect, as tuber-

¹⁰¹ Journal of the American Medical Association, 1919, lxxiii, 1693.

culosis was suspected in 1, and the other never had a high metabolism. One died following operation. This patient had received one treatment a few days previously. Two died during the period of treatment from intercurrent disease; 6 had less than the required number of treatments, making a total of 10 in which failure to obtain relief was not due entirely to the method of treatment. In the 3 remaining cases, 2 patients showed only slight improvement after prolonged treatment and may definitely be classed as failures (they were comparatively young patients, between twenty-five and thirty years old). In the remaining cases, myxedema developed, possibly as a result of overtreatment. The number of treatments in Group 3 averaged the same as those of Group 1, but the duration of treatment was rather longer.

4. Patients in whose cases fairly complete data were obtained, at least one basal metabolism record was made, and sufficient time had elapsed to warrant a definite opinion as to the final result. The cases in this group are selected from the other three. In this group there were 36 cases. In all of them the final observations were made by a disinterested clinician. Seventeen of the patients were perfectly well, while 13 were improved, making a total of 30 who were definitely benefited by the treatment. In 4 of the cases the diagnosis was incorrect, as proved by the metabolism determination and the future course of the disease. One patient was operated on without relief; 2 had recurrence of symptoms that responded to future treatment, and in 1 case myxedema developed as a result of overtreatment. One patient died from unknown cause during the course of treatment.

The treatment should be applied to both the thymus and the thyroid regions. Fairly hard rays should be used, and the treatment should not be repeated until three weeks have elapsed. After a series of three treatments, there should be an interval of three months before resuming treatment; then a second series of three treatments should be given. If the symptoms have not sufficiently disappeared at the end of this period, a third series should be given, making nine treatments in all. Consequently, during this time, the patient will have been under observation about one and a half years.

Holmes and Merrill insist on the importance of careful diagnosis and the selection of patients to be treated. If the case is one of thyrotoxicosis, after the second or third treatment the patient usually expresses a feeling of relief from the disagreeable nervous symptoms, the pulse-rate becomes lower and there is a gain in weight. About a year after treatment is begun there should be considerable diminution in the size of the thyroid gland. Exophthalmos never entirely disappears. Except in the more severe cases, the patients have continued their usual habits of life; but we believe that it is of definite advantage to have the treatment supplemented by rest, as in this way the duration of treatment will be shortened. Usually at the end of six months the patients are sufficiently relieved to resume their ordinary occupation without difficulty or discomfort. To be sure, the relief from symptoms is not so quickly obtained as by surgery, but the dangers are less, and in the milder cases it obviates the necessity of interfering with the daily life of the patient.

These are factors that should be considered when deciding as to the form of treatment.

If relief is not obtained by x-ray after nine treatments, or if, for any reason, it is desirable to hasten results, surgery may be recommended. The previous treatment by x-ray will be of benefit, as it reduces the operative risk by destroying the thymus gland. After x-ray treatment some operators have complained of adhesions and increased bleeding at time of operation; but such has not been the experience of the surgeons in this clinic.

Thymus. FUNCTION. Of all the endocrine glands the thymus is the least understood. Thymectomy in animals is an operation of such severity that it is difficult to dissociate the immediate results of shock, etc., from the physiologic effects of loss of thymus influence. The presence of accessory thymus bodies introduces a factor of difficulty in the interpretation of results. Blatz,¹⁰² who has reviewed the recent literature bearing on the function of the thymus gland, states that the most complete work to date on experimental thymectomy is that by Tongu.

The results of his observations are tabulated as follows: (1) Body weight—no influence after thymectomy. (2) Growth—no effect—Klose and Vogt 3 stages not shown. (3) Nervous, psychic—no effect. (4) Blood corpuscles—no effect—number of differential. (5) Change in opsonic index—no change not explained by operation results. (6) Blood-pressure—results conflicting. (7) Histologic—no change—sometimes found thymus accessory bodies, but they did not seem to affect the result. (8) Skeletal system—no change in length, structure, calcium content, callus formation after fracture, etc. (9) Changes in other organs—none. Blatz states that it is clear from a review of the literature bearing on the thymus, that it is impossible to attribute any function to the gland.

He reiterates what he has stated elsewhere, namely, that whatever the real function of the gland, it is certain that its production of an internal secretion has not been proved. He quotes Hoskins who considers the thymus as a lymphoid organ functioning in infancy and childhood when a large number of lymphoid cells and leukocytes are needed to combat infections. Blatz expresses a similar opinion when he compares the thymus to an enlarged tonsil which involutes when its presence is no longer necessary. Since the publication of Blatz's paper there appeared the studies of Park and McClure.¹⁰³ These studies, which included a critical review of the literature and experiments in animals, came to the same conclusion, namely, that extirpation of the thymus is without direct influence.

Schmidz, in the study of thymus function, was able to cause early involution of the gland by the injection of a serum specifically cytolytic for the thymus. In a second report which has recently appeared, he¹⁰⁴

¹⁰² *Journal Laboratory and Clinical Medicine*, 1919, v, 50.

¹⁰³ *American Journal Diseases of Children*, 1919, xviii, 317.

¹⁰⁴ *Mitteilungen a. d. med. Fakultät, d. k. Univ. Tokyo*; Abstract, *Journal American Medical Association*, 1919, lxxiii, 729.

discusses the "thymus immune serum," with special regard to the reciprocal relation between the thymus and lymph apparatus and suggests that the thymicolymphatic state may be directly traced to some early acquired injury to the thymus.

THYMUS IN RELATION TO THE THYROID. Within the past several years increasing observation has confirmed the importance of the relationship of the thymus and the thyroid in exophthalmic goiter. The importance of this association justifies, in the minds of some, the term thyroid-thymus syndrome for Graves's disease. It will be recalled that Blackford and Freligh, in 1916, according to McCaskey,¹⁰⁶ concluded from their study of 74 necropsies that an enlarged thymus is present in 100 per cent. of patients under forty years of age, and in about 50 per cent. of those above forty, in whom the average weight of the thymus was 13 gm. Halsted previously affirmed that the important role played by the thymus in exophthalmic goiter was demonstrated beyond question by animal experimentation, and especially by the cures resulting from primary thymectomy and also from secondary thymectomy following thyroidectomy which alone had been unsuccessful.

Eddy,¹⁰⁶ in discussing the role of the thymus gland in exophthalmic goiter, calls attention to the fact that enlargement was first noted by Markham in 1858. Bonnett has recorded 28 cases of persistent thymus in exophthalmic goiter with hyperplasia of the gland in 4 of 6 cases which had a sudden fatal termination. Cappelle reported 61 cases of exophthalmic goiter which showed at necropsy enlarged thymus in 79 per cent. Eddy has been able to gather from the literature reports of 240 separate cases of exophthalmic goiter in which definite mention of the thymus is made. These show an enlargement or persisting gland in 201, or 83½ per cent. His bibliography contains 80 references to the authors who have reported these cases.

Although the connection between the thymus gland and exophthalmic goiter is indicated by this review, it is not possible to state the nature of this relationship. Eddy states that it is possible that the thymus acts independently of the thyroid in producing Basedow's disease. It is also possible that it becomes hyperactive as the result of increased activity of that gland, adding its harmful influence to that exerted by the abnormally functioning thyroid; or, its hyperplasia and hypersecretion may be the result of an effort to render harmless the toxic products of the thyroid. Still another conception of the etiology of Graves's disease that must not be overlooked is that suggested by Crile, namely, that neither the thyroid nor thymus is primarily at fault, but that there is a third cause which is unknown, and that the changes observed in these glands and the symptoms attributed to alteration in their function are the result of the operation of this unknown factor. An array of facts can be marshalled in support of each of the hypotheses mentioned, all waiting for the discovery that will harmonize them and make clear the present apparent contradictions. Eddy attempted to determine, by experiments on rabbits, whether an excess of thymus

¹⁰⁶ Journal of the American Medical Association, 1919, lxxiii, 243.

¹⁰⁶ Canadian Medical Association Journal, 1919, ix, 203.

principle in the circulating blood could cause exophthalmic goiter or not. Two rabbits served as a control. Three rabbits were given hypodermic injections of thymus substance in the proportion of 5 mgm. per kilogram of body weight, and three in the proportion of 10 mgm. per kilogram. Forty injections were given to each rabbit. There was no evidence of the production of symptoms characteristic of exophthalmic goiter in either group of rabbits. We may assume from our present incomplete knowledge that the exact status of the thyroid thymus relationship has not been established.

A *lymphosarcoma of the thymus* is reported by Strauss.¹⁰⁷ The thymic neoplasm invaded the heart, penetrating the wall of the right ventricle and completely obliterating the superior vena cava. A collateral circulation was established through the subclavian veins, cutaneous vessels, superior epigastrics, iliacs and inferior vena cava. Strauss states that he was able to find only one other similar case recorded in the literature.

THYMUS DEATH. Practically every year one can find in the literature references to sudden death during or following an operation and attributed to the thymus or thymico-lymphatic state. Burger¹⁰⁸ reports such an instance occurring in a youth of fifteen, under chloroform for tonsillectomy. The anesthesia and the operation had proceeded smoothly, but the heart action and respiration stopped immediately after the operation had been concluded. Necropsy showed the thymus more than twice the normal size, and the thymicolymphatic state explained the fatality. The importance of thymus death following tonsillectomy is emphasized by Burger's case and by the two which he found on record; thus the only fatality among 6000 tonsillectomies by Kofler and 10,000 tonsillectomies by Kafemann was due to this cause. Burger states that there does not seem to be any certain means for detecting the thymico-lymphatic status beforehand and an aneurysm or retrosternal goiter may simulate a large thymus. In the editor's opinion, it would seem wise to subject the patients who are suspected of thymic hyperplasia to careful x-ray studies, and while it may be difficult to differentiate the cases of retrosternal goiter, aneurysm is practically unknown at the age when most of these thymic deaths occur.

DIAGNOSIS. The differentiation of the enlarged thymus from intrathoracic goiter must be particularly confusing when the latter is of the so-called true type, namely, without showing involvement of the gland in the neck. In an adult, however, the infrequency of thymic enlargement would lend weight to the possibility of intrathoracic goiter when the fluoroscope shows the shadow in the upper portion of the mediastinum. In Leiner's¹⁰⁹ case the intrathoracic goiter was associated with thyrotoxic symptoms and the patient definitely improved under thymus therapy.

TREATMENT OF ENLARGED THYMUS. Grulee¹¹⁰ reports a case of enlarged thymus and tuberculosis of the peribronchial glands in which

¹⁰⁷ New York Medical Journal, 1919, cx, 646.

¹⁰⁸ Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, May 31, 1919, No. 22, 1; Abstract, Journal of the American Medical Association, 1919, lxxiii, 801.

¹⁰⁹ New York Medical Journal, 1919, cx, 190.

¹¹⁰ International Clinics, 1919, iii, 42.

the thymus was producing dyspnea from pressure on the trachea. By the use of the *x*-rays the thymus was reduced in size and the reduction was accompanied by cessation of the dyspnea. Birk¹¹¹ reports 5 cases in which the excessively large thymus promptly shrank to normal size under *x*-ray treatment. In 1 case the gland enlarged again later, but in all the others the cure was prompt and permanent. The beneficial influence of radium is claimed by Brayton and Heublein.¹¹² These writers report the case of an infant seen two years prior with desperate thymic asthma. Owing to the severity, radium was used instead of the *x*-ray in the hope that its effect might be more prompt. The results of this substitution were so satisfactory that since then radium has been used exclusively in both their hospital and private cases. The promptness of the response to radium gives it an advantage over the *x*-ray. Other advantages are one treatment alone suffices to effect a cure, even in the severest forms of the disease; radium is portable, thus obviating the difficulty of transporting the patient to a roentgen laboratory; the application of radium is simple, thus eliminating the dangerous element of fear from the mind of the patient, and at the same time rendering unnecessary the use of an elaborate *x*-ray equipment.

The Pituitary Gland. During the past year a monograph on the pituitary by Blair Bell appeared in which the author has endeavored to present a more or less complete summary of the subject. He quotes much from the work of others and considerable from his own extensive experience. It is interesting to note, as he states, that after many centuries spent in unprofitable speculation and fruitless investigation, the far-reaching and vital importance of the pituitary has at last come to be fully recognized.

The history of the gland is interesting. For ages the subject of curiosity and strange beliefs it was supposed to secrete phlegm (pituita, meaning phlegm) into the nasal cavities. Later, Viesseus, Sylvius, and others, considered it as concerned in the function of the cerebro-spinal fluid. And what seems to give priority to Richard Lower in regard to the hypothesis of internal secretion is quoted by Bell from an article written by this author in 1672. "For whatever serum is separated into the ventricles of the brain and tissues out of them through the infundibulum to the glandula pituitaria distils not upon the palate but is poured again into the blood and mixed with it."

Bell comments upon the fact that the present-day terms used in the literature are confusing, and he defines them as follows: The term hypophysis to refer to that portion of the pituitary which is derived from the buccal ectoderm and includes pars anterior and pars intermedia. Since no extract is made from this portion of the pituitary, the term hypophysin has no meaning. The pars nervosa and the pars intermedia constitute in the human subject the posterior lobe and the term infundibulin is applied to the extract made from the posterior lobe.

In discussing the gross anatomy, he notes that various observers have recorded weights and dimensions which show some discrepancy.

¹¹¹ Abstract, Journal of the American Medical Association, January 25, 1919, 16.

¹¹² Boston Medical and Surgical Journal, 1919, clxxxi, 740.

The outstanding fact, however, is that pregnancy causes an increase in the weight of the organ and after middle life there is a gradual decline in the average weight. We cannot follow the author into the many details of the comparative anatomy of the pituitary except to state that all vertebrates higher than the elasmobranch have a definite pars nervosa from which active extracts are obtainable.

In Part II, which deals with the physiology of the gland and the methods of investigation, one finds reference to the fact that in certain physiological states marked changes occur in the pars anterior. Enlargement and increased activity occur during pregnancy. There is an increase in the degree of eosinophilia and the presence of chromophobe cells. Hibernation in animals also produces striking changes in the histological appearance of the epithelial elements of the pars anterior. The author agrees with Paulesco and Cushing that total extirpation or removal of very large portions of the pars anterior is fatal, also that the removal of the pars posterior produces no symptoms. The author also finds that the genitalia not only do not atrophy, but continue to develop in the young female after removal of this portion of the pituitary. He differs from Cushing in finding that in none of the cases in which portions of the pars anterior were removed did dystrophia adiposogenitalis—with its lowered blood-pressure and sugar tolerance—supervene. This syndrome, however, occurs after compression and separation of the infundibular stalk. The author reconciles these diverging views by assuming that this syndrome is primarily produced by insufficiency of the pars anterior, and that the only sure way to effect this is to interfere with the blood-supply. The interrelations of pituitary activity with that of the thyroid and ovaries is fully dealt with.

In Part III, Bell considers the disorders associated with the pituitary and their treatment. Under *hyperpituitarism*, which implies abnormal activity of the whole organ, most authors infer that only epithelial elements are concerned. The term hyperhypophysism implies abnormal activity of the pars anterior, and is a normal condition in pregnancy. No one has succeeded in producing the symptoms of hyperhypophysism by the administration of hypophysial extracts to the human subject or to animals. Results of pathologic hyperhypophysism depends upon the period of life and the sex of the patient. If the subject be a boy, sexual precocity may occur. In the cases on record, however, the evidence is incomplete or conflicting as to whether the pineal gland may not have been concerned (Cushing and Poynton); but the fact that in girls hyperplasia of the pars anterior leads to the manifestations of precocious masculinity-hypertrichosis, a deep voice and the rest, gives point to the view that the pituitary may sometimes be concerned in the way indicated in regard to masculine precocity.

When the onset of hyperhypophysism occurs before the epiphyses have joined, a remarkable growth of the skeleton follows, and gigantism results. If the disease commences late in life when the epiphyses have joined, then, of course, gigantism does not supervene, but the typical skeletal changes of acromegaly are produced.

The only specific disease known to be produced by hyperpituitarism

is acromegaly, for although gigantism may be associated with this condition, well-marked skeletal development cannot be considered pathological in the absence of acromegaly. It may, in fact, be due merely to adolescent hyperphypophysism, just as one sees in girls hyperthyroidism at puberty—a condition which produces a temporary effect that subsequently subsides.

Hypopituitarism may exist as a congenital lesion, but such a state is difficult to determine, for it is not until the child is growing up that signs of the lesion become recognizable. *Hypopituitarism occurring before puberty* gives rise to three distinct conditions: (1) Infantilism, somatic and sexual, without adiposity (Lorain type); (2) stunted growth with sexual infantilism and adiposity; (3) overgrowth with some adiposity and genital inactivity. The relation of the Lorain type to pituitary lesions was first noted by Levi, and an interesting case report is that of Rennie who records a case due to endothelioma of the pituitary. The second condition known as the dystrophia adiposogenitalis of Frolich is amply illustrated by the cases on record. One of the most interesting recalled by Bell is that of Madelung in which a girl nine years of age was shot with a rifle bullet which lodged in the sella turcica. The child developed the typical symptoms of this syndrome, but these were not recognized as such when the case was reported. Most of the cases, however, have been due to neoplasms or cystic formations in the pars anterior.

The third group of cases of preadolescent hypopituitarism is that described previously by Neurath and Cushing. The clinical notes of such a patient are given by Bell as follows: This patient came under observation at the age of eighteen and one-half years, being referred by her father, who is a doctor. Her only complaint was that she had not menstruated. Upon examination, the uterus was found to be infantile-rudimentary, it was thought at the time. A radiograph of the sella turcica showed this fossa to be remarkably small. When first seen the patient was a bright, handsome, finely developed girl measuring 5 feet 8½ inches in height and weighing 156 pounds. The carbohydrate-tolerance was over 350 grams of dextrose—that is to say, no sugar appeared in the urine after this amount had been consumed, and it was impossible for the patient to take more. Two years later her father wrote to say that she weighed 214 pounds in spite of the administration of whole-gland pituitary extract. After that time the administration of pituitary extract was discontinued. Recently, at the age of twenty-three years, the patient has commenced menstruating regularly. It is this last fact which almost places the case in a category of its own.

Hypopituitarism after puberty in its milder forms is undoubtedly much commoner, according to Bell, than is generally supposed. The patients are usually of the female sex between twenty-five and thirty-five years of age. The most prominent symptoms are increasing obesity, lassitude and amenorrhea. Advice is usually sought for the menstrual suppression. At first the amenorrhea alternates with irregular and scanty menstruation, and finally this function ceases. In the adult, as in the child, hypopituitarism produces the definite syndrome, dystro-

phia adiposogenitalis—the male assumes a feminine form and the female ceases to menstruate. Genital atrophy and impotence occur. Blood-pressure is low, the temperature is subnormal and there is a markedly increased carbohydrate tolerance if the lesion is due to a pituitary tumor, headaches, visual disturbances, etc., or from intracranial pressure.

Two cases of the adiposogenitalis syndrome in adults are reported by Lereboullet and Hutinel,¹¹³ one a woman of forty and the other a man of thirty-three years; both with pathologic changes in the pituitary. Improvement followed the administration of pituitary, the woman receiving in addition polyglandular treatment. These authors call attention to the possibility of involvement of the other ductless glands, and several cases have occurred in their experience in which thyroid disturbance was suggested at first by the clinical appearance of the patient, but the loss of vision and manifest lesions in the sella turcica pointed to the pituitary as the primary gland at fault. They also call attention to the possibility of an underlying syphilis or tuberculosis which, when treated, offer a better chance for improvement under opotherapy. They administer the pituitary treatment by the subcutaneous route.

The evidence of the RELATIONSHIP OF DIABETES INSIPIDUS TO LESIONS OF THE PITUITARY has been frequently demonstrated at necropsy; in fact, according to an editorial¹¹⁴ discussion of this subject there are no records in which the pituitary was examined and found to be perfectly normal. In dystrophia adiposogenitalis, polyuria may be pronounced; in acromegaly, both polyuria and glycosuria may be present, and in certain types of infantilism associated with pituitary disease, the passage of large quantities of urine may be an outstanding feature. It has been noted, too, that tumors in the neighborhood of the hypophysis which exert pressure on this gland can be associated with the clinical picture of diabetes insipidus. Kennaway and Mottram¹¹⁵ have added clinical evidence to the problem of pituitary function in connection with the kidney. The antidiuretic effect of pituitary extract given by subcutaneous injection was demonstrated both in a normal subject and in a case of diabetes insipidus. Administration of such preparations by mouth is ineffectual. Kennaway and Mottram maintain that the immediate restoration of a normal state of the urine when pituitary extract is administered in diabetes insipidus provides the strongest evidence for the normal activity of the gland in regulating the secretion of urine.

Lereboullet¹¹⁶ describes the case of a man of fifty, who had retrogressive infantilism, impotence, asthenia, falling of the hair and tendency to obesity. There was also polyuria. Treatment of various kinds proved futile until pituitary treatment was given, and then the output of urine dropped from the 7 or 8 liters, which had been the average for ten years,

¹¹³ Bulletins de la Société Médicale des Hôpitaux, 1919, xliii, 745.

¹¹⁴ Journal of the American Medical Association, 1919, lxxiii, 1615 and 1920, lxxiv, 398.

¹¹⁵ Quarterly Journal of Medicine, 1919, xii, 225.

¹¹⁶ Progrès Médical, 1919, xxxiv, 363.

to the normal figure as long as the pituitary treatment was kept up. The extract from the posterior lobe alone was most effectual.

While the literature contains abundant examples of how the administration of pituitary extract controls polyuria of pituitary origin, this treatment is only symptomatic. Clearing up polyuria does not affect the underlying lesion, for example, tumor, gumma, etc. This point is illustrated by the case report of Berge and Schulmann,¹¹⁷ in which the polyuria was controlled when the patient was given extract of the posterior lobe of the pituitary gland. Death, however, eventually occurred and necropsy revealed eight gummatous lesions of the pituitary, mostly of the posterior lobe.

Marañón and Gutierrez¹¹⁸ are of the opinion that an increase in the pressure of the cerebrospinal fluid is a factor producing polyuria in lesions of the pituitary. In one of their 3 cases the output of urine dropped from 5600 to 3200 after the escape of 40 c.c. of fluid by lumbar puncture; in the second case the output dropped from 12,000 to 8700.

HEADACHES OF PITUITARY ORIGIN have been reported by Pardee,¹¹⁹ who believes that they are of fairly common occurrence. The headache is located between the temples, deep behind the eyes and is accompanied by dispituitary signs. The headache is described as a tightness between the temples, feeling of pressure or distention, or an intense bursting sensation. It is frequently persisting, lasting from one-half hour to forty-eight hours. It often leaves suddenly, returning again with exacerbation; it is accentuated by excitement, stooping over, and by the ingestion of sugar. At the climax of the headache there may be nausea and vomiting, with which there comes relief. The x-ray shows an abnormality of the sella turcica. The recognition of headache due to this cause is important because administration of the whole gland, for example $\frac{1}{4}$ grain to 2 grains three times a day, cures them and the accompanying symptoms in a large percentage of cases, provided, of course, there is no progressive neoplastic growth. Pardee gives the case records of seven of his patients illustrating the value of this therapy.

Tucker¹²⁰ believes that there is a definite relation between the undersecretion of the pituitary gland and a group of periodic convulsive attacks usually termed epilepsy; that this group is divided into a chronic hypopituitary type and a transitional hypopituitary type by both clinical and roentgenographic evidence; and that pituitary gland feeding has a markedly beneficial effect occasionally leading to cure.

Suprarenal Glands. SUPRARENAL INSUFFICIENCY. During the epidemic of influenza it was a common observation that asthenia was present out of all proportion to the other symptoms and oftentimes persisted far into convalescence. In a series of cases published by Cowie and Beaven¹²¹ they were unable to satisfy themselves that the prostration was due to cardiovascular disease and turned their attention

¹¹⁷ Presse Médicale, 1918, xxvi, 618.

¹¹⁸ Siglo Médico, 1919, lxvi, 809, Abstract, Journal of the American Medical Association, November 22, 1919, 1649.

¹¹⁹ Archives of Internal Medicine, 1919, xxiii, 174.

¹²⁰ Archives of Neurology and Psychiatry, 1919, lxiii, 556.

¹²¹ Journal of the Michigan Medical Society, 1919, xviii, 42.

toward disturbed function of the suprarenals. In this connection it is noted that the French school, and particularly Josue, Neter, Sergeant, Renon and Florand, has emphasized the belief that suprarenal pathology is present in influenza and responsible for the asthenia. In further support of this view, Cowie and Beaven report a personal communication from Kelman and Calhoun who found evidence of suprarenal disturbance in a series of over 20 autopsies. In their own series of 11 cases, the necropsy findings showed 6 cases of hypoplasia, 1 case of moderate atrophy and no cases of hemorrhage or necrosis. These authorities call attention to the fact that perverted function of the suprarenals may exist without demonstrable pathological change, as occurs at times in other organs. In a subsequent communication they¹²² state the most common and the most marked symptom of suprarenal insufficiency is asthenia (prostration). Low blood-pressure, another cardinal symptom of suprarenal insufficiency, has been commonly observed by clinicians as characteristic of influenza and influenzal pneumonia.

The clinical evidences of suprarenal insufficiency, namely, asthenia prostration and lowered blood-pressure were invariably present, and in addition other symptoms common to the disease which are characteristic of acute suprarenal insufficiency not of influenzal origin, such as nausea, vomiting, abdominal pain (epigastric and appendiceal), pains in the back and even tenderness on pressure over the back muscles, and in a few cases diarrhea. The writers recall that Lavenson has attempted a grouping of various symptoms presented by the cases of known suprarenal insufficiency which have been recorded, describes (1) what may be called the abdominal type in which sudden death was preceded by marked abdominal symptoms; (2) the asthenic type; (3) the nervous type characterized by convulsions, and (4) cases of sudden death in which at necropsy no pathology except that present in the suprarenals could be found. In influenza and influenzal pneumonia it is not difficult to differentiate cases suitable to the first three groupings.

In order to more definitely test suprarenal insufficiency they resorted to the use of adrenalin which produced (1) a characteristic rise in blood-pressure following prolonged administration and the prolonged blood-pressure curve following the administration of adrenalin; (2) a prolonged blood-sugar curve after injection of adrenalin; prolonged blood-sugar curve after ingestion of glucose. Unfortunately, the use of epinephrin therapeutically was of little, if any, benefit. This, however, cannot be considered as evidence against renal insufficiency, because it has been found ineffective in cases of Addison's disease with demonstrable lesions in the suprarenals. In the discussion of the above paper, Blake¹²³ stated that in a series of 250 autopsies of cases of influenzal pneumonia at Camp Pike, 2 cases with markedly hemorrhagic suprarenals were found. Rosenow¹²⁴ stated that it was interesting to note in connection with Cowie's clinical observations, that the experimental injection of guinea-pigs with strains from typical cases of influenza produced swelling, edema and hemorrhage of the suprarenals.

¹²² Archives of Internal Medicine, 1919, xxiv, 78.

¹²³ Journal of the American Medical Association, 1919, lxxiii, 787.

¹²⁴ Ibid.

Satre and Gros¹²⁵ report a study of suprarenal insufficiency among troops; a condition which they call *war hypoadrenalic syndromes* in which the administration of adrenalin cured the disturbance, particularly when manifested by gastro-intestinal disturbance, diarrhea, etc. The men thus affected had led a sedentary life before the war, and the functioning of their weak suprarenals had sufficed for their regular indoor life, but under the stress of campaigning the insufficiency of their endocrine system soon made itself manifest. The symptoms reveal the inability of the antitoxic functions to cope with the excessive amounts of poisons generated by the waste from muscular work. Whether there is merely functional suprarenal upset or organic damage, the fundamental symptoms are the same, vomiting, dizziness, asthenia and hypotension—just as in sea-sickness. There may be also small, brownish spots on the skin, symmetrically distributed. When the solar plexus is irritated, there are liable to be apoplectiform coma or pseudomeningitic symptoms, vasomotor disturbances, etc. The blood-pressure is low in all the forms. Large and fractioned doses of adrenalin are indicated, with ingestion of the total extract of the suprarenals. The adrenalin and extract of the capsule have a tonic and cardiovascular action remarkably effectual, promptly raising the blood-pressure and acting energetically to promote diuresis. The digestive intolerance usually makes it necessary to give the adrenalin by intramuscular injection.

A case of suprarenal insufficiency occurring in the military service was reported by Boyd.¹²⁶ A patient, aged thirty-eight years, was found semiconscious and presented a picture suggestive of cerebral hemorrhage. The limbs were rigid, the reflexes gone, and the pupils distinctly dilated. The face and hands were cyanosed. The temperature was 99° F. Urine was normal. Cerebrospinal fluid showed no change and gave a negative Wassermann reaction. The patient died two and a half hours after admission. At necropsy, the only organ exhibiting any marked pathologic change were the suprarenals. These were almost entirely destroyed, and converted into structureless, amorphous, yellowish masses, firm in texture, and considerably larger than the original glands.

Two foreign observers, Nuñez¹²⁷ and Barreiro,¹²⁸ note an early frequent involvement of the suprarenals in typhoid fever and the benefit from the injection of adrenalin. Nuñez states that the suprarenals are involved in typhoid both early and constantly, as a rule. This is the cause of the hyposthenia, the hypotension, the hypocholesterolemia, the dicrotic pulse and the dissociation between the pulse and the temperature. He makes a point of daily subcutaneous injection of adrenalin in every case of typhoid in which one or more of these five

¹²⁵ Progrès Médical, Paris, 1918, xxxiii, 205; Abstract, Journal of the American Medical Association, 1919, lxxii, 229.

¹²⁶ Journal of Laboratory and Clinical Medicine, 1918, iv, 133.

¹²⁷ Anales de la Facultad de Medicina, Montevideo, 1918, iii, 648; Abstract, Journal of the American Medical Association, 1919, lxxii, 1501.

¹²⁸ Boletín de la Asoc. Med. de Puerto Rico, San Juan, 1919, xiii, 38; Abstract, Journal of the American Medical Association, 1919, lxxii, 364.

symptoms are observed. Barreiro reports 20 cases and the benefit from adrenalin treatment was so great that he does not wait for further experience before proclaiming the advantages of suprarenal treatment in typhoid in the tropics. In the tropics the suprarenals soon become unequal to their task, as is evident from the intense weakness and low blood-pressure early in typhoid. The theoretical indication to supply the lacking suprarenal element was abundantly confirmed by the prompt improvement under suprarenal treatment. In a day or two the benefit was plainly evident, the patient feeling stronger, replying lucidly to questions, and the amount of urine increasing while it grew more normal in appearance. It was an actual resurrection in some cases by the second day after three drops of the 1 : 1000 adrenalin had been given by the mouth in a glass of water, twice a day. The improved muscle tone was particularly evident in the tongue which at first was not under control at all. Since he began this routine use of epinephrin in tropical typhoid he has not lost a case.

SUPRARENAL OVERFUNCTION. This term is used in contradistinction to the heading of the preceding paragraph and is synonymous with hyper-suprarenalism and hyperadrenalism, states in which the blood contains an excess of the secretion of the gland. Hyperadrenalism before birth is described by Pirie¹²⁹ as of importance in the etiology of congenital pyloric hypertrophy and subsequent obstruction. He states that the experimental evidence available shows that only one condition will produce spasm of unstriated muscle, and that is hyperadrenalism. He suggests that this condition existing before birth is the chief cause of the pylorospasm and that other subsidiary postnatal causes determine the persistent recurrence of the spasm. He reports the case of an eight-weeks-old boy, normally born and apparently healthy at birth, who was brought to the hospital because of vomiting at irregular intervals since birth, wasting and distended abdomen. Before the clinical investigation could be completed, the child died, and postmortem revealed esophageal and pyloric stenosis with definite thickening of the former. The right suprarenal gland was normal, but the left was enlarged to about one-third the size of the kidney. Elliott, who examined the section, expressed the opinion that the enlargement was entirely confined to accessory cortical cells. Pirie holds that although hyperadrenalism as a cause of congenital pyloric hypertrophy cannot be proved, the evidence seems to offer a reasonable explanation. The importance of the internal secreting glands in the study of diseases of children is granted, but their exact status is far from being clear. This point may be emphasized in regard to the above, when it is recalled that Rathford, who reported the postmortem examinations of 6 children who died from pyloric stenosis, found nothing except an abnormally enlarged thymus gland. One might just as reasonably argue that the thymus, rather than the suprarenal, is the causative factor in this condition.

TRAUMATIC AND TUBERCULOUS LESIONS OF THE SUPRARENAL. Dürck,¹³⁰ reports the following case of traumatic Addison's disease: A

¹²⁹ *Lancet*, 1919, cxvii, 513.

¹³⁰ *Aerztl., Sachverständ. Ztg.*, 1919, xxv, 73-81; Abstract, *Lancet*, July 5, 1919.

hitherto healthy man, aged forty-eight years, was caught between a railway carriage and a revolving platform and had four ribs fractured. Apparent recovery took place, and he was able to resume his work in about six weeks, but a week later he had to give up owing to weakness in the arms and legs and palpitation. Bronzing of the skin of the face and hands gradually set in and the muscular weakness increased. Treatment consisted in the administration of suprarenal preparations, and death did not take place until about eight years after the incident. The autopsy showed considerable bronzing of the skin of the face, hands, forearms, and external genitals, and apparently complete absence of both suprarenals with a healed fracture of the sixth to the ninth ribs on the right side. On microscopic examination some necrotic fragments representing the remains of the medulla of the left suprarenal were found, while on the right side there was hardly any trace of the suprarenal, but remains of blood pigment indicated that a hemorrhage had formerly taken place in this situation a long time previously. Tuberculosis could be excluded and there was no evidence of syphilis.

Willems and Goormaghtigh¹²¹ reported the study of suprarenals in 90 autopsies conducted during the course of the war. Traumatic lesions of the suprarenal were found in three instances and tuberculosis in four. In the first case the hemorrhage into the suprarenals was detectable only on microscopic examination. The patient had suffered a gunshot wound of the abdomen with the production of a retroperitoneal hematoma. The second patient had been subjected to a violent trauma and the suprarenal was injured, in addition to the spleen, liver, kidney and intestine. The third patient was an elderly man who had been crushed by a street car, with the production of a hematoma on the right suprarenal and complete destruction of the medulla and upper portion of the cortex, in which case the rapidity of the fatal termination was amply accounted for by the other injuries which were sustained in addition to the suprarenal injury. Among the four instances of tuberculosis of the suprarenals in soldiers succumbing to wounds, 3 were unilateral and 1 bilateral. In the unilateral cases there was nothing in the clinical course to suggest impairment of the suprarenal function. In the bilateral case the rapid death of the patient who had sustained only a relatively slight wound of the lower extremity was ascribed by the authors to the bilateral suprarenal involvement. They state that the somewhat peculiar variety of shock which the man exhibited, with sudden, marked lowering of the blood-pressure, followed by complete disappearance of the pulse, vomiting, and pronounced agonal convulsions, appears to have been the result of suprarenal insufficiency. The writers conclude that the possible presence of suprarenal lesions should always be borne in mind in certain varieties of traumatic shock with vomiting unaccounted for by any abdominal lesion.

NON-TRAUMATIC HEMORRHAGE OF THE SUPRARENAL. While the occurrence of hemorrhages into the suprarenal of traumatic origin have been found not infrequently at postmortem, a non-traumatic hemorrhagic

¹²¹ *Presse Méd.*, 1919, xii, 109.

lesion is exceedingly rare. Lusk and Brumbaugh¹²² report an instance of this kind in which the lesion was apparently due to the *Streptococcus hemolyticus* which was isolated from the blood antemortem and post-mortem. The patient was diagnosed as severe septicemia. The authors think it is reasonable to assume that by the lodgment of a bacterial embolus either in a vessel wall or a vessel itself, a dissolution of the vessel occurred, resulting in hemorrhage and death. The clinical picture up to a few hours before death was that of a severe septicemia, and such was the antemortem diagnosis.

PIGMENTATION OF ORAL MUCOSA UNASSOCIATED WITH ADDISON'S DISEASE. Pigmentation of the mucous membranes, like pigmentation of the skin, is occasionally met with in the absence of suprarenal disease. Parkes Weber¹²³ reports such a case and comments upon its occurrence as follows: The pigmentation is in the form of blackish spots and patches in the mucous membrane of the lips or cheeks and sometimes of other parts of the mouth. The pigment patches may be analogous to simple pigment nevi of the skin or to freckles. They may be allied to the black patches which are not uncommonly found in mucous membranes in dogs and other animals. They may be racial or atavistic. In a few cases they have seemed to be casually related to pernicious anemia. In some cases they may have been set up by local hemorrhages and inflammatory complications connected with foul teeth and pyorrhea. At least one observer has attributed the pigmentation to syphilis. Weber refers to the previous report of Jonathan Hutchinson who was probably the first to call attention to the kind of pigment. He records the case of two girls, twins, brunettes and quite healthy, both of whom at the age of nine years developed freckle-like pigmentation about the mouth. The distribution of the pigmentation was exactly the same and the cause unknown. Such pigmentation occurs more commonly in persons of dark complexion, especially in Roumanian Jews and in certain races, such as the Lascars.

MESOTHELIOMA OF THE SUPRARENALS. Tumors of the suprarenals have been the subject of considerable discussion among pathologists from time to time as regards their origin and classification. Harris¹²⁴ states that following Grawitz many of these tumors have been rightly classified as hypernephroma, but others erroneously so called. He reports a case which he considered a mesothelioma involving both suprarenals and presenting metastasis of both lungs, with hemothorax. The case history is of interest and is briefly as follows:

A colored male, aged forty-eight years, was brought into the hospital in a moribund condition and died the following day. About five weeks previously he noticed "a swelling in the right side of the chest." He had a cough and fever, and suffered from shortness of breath. He suffered extreme pain in both sides of the chest, difficulty in breathing and diarrhea. Physical examination revealed an emaciated, anemic negro male, restless, anxious and dyspneic. The respirations were rapid

¹²² Journal of the American Medical Association, 1919, lxxii, 1062.

¹²³ Quarterly Journal of Medicine, 1919, xii, 404.

¹²⁴ American Journal of Medical Sciences, 1919, clvii, 602.

and shallow and chiefly abdominal in type. The right side, while more prominent, was almost stationary during respiration. The right side from the third rib down anteriorly and laterally, and also posteriorly, showed a marked distention, with bulging of the intercostal spaces. No voice fremitus was felt over the entire right lung, but a slight increase was evident on the left side. There was a localized edema of the right chest wall. The lower edge of the liver is displaced downward as far as the umbilicus. Percussion elicits flatness over the entire right chest; the left side is practically normal. Over the right lung the voice and respiratory sounds are only barely audible; over the left lung, scattered rales of the coarse and fine moist varieties are heard throughout. The right pleural cavity was aspirated and blood withdrawn.

Upon the following morning the patient was in a state of collapse; his pulse was very rapid and barely perceptible and he was bathed in a cold perspiration. He died shortly afterward. The clinical diagnosis made was bilateral pulmonary tuberculosis, with right hemothorax.

The autopsy revealed the right pleural cavity filled with a dark brown fluid and at the lower portion of the cavity, clots are found. The lungs were totally adherent laterally to the costal pleura as far back as the spinal column. The right pleura was found studded with small nodular areas which gave the appearance of dark skin and appeared tuberculous in character. The left pleural cavity was dry. The lung was slightly adherent to the costal pleura; of a gray color and studded on the surface with small grayish nodules; it crepitated fairly well on palpation, but was very nodular. On section the organ was of a red color and presented throughout small, yellowish-white and grayish-white masses, and large areas which were necrotic in the center. These varied in size from 2 mm. to 2 or 3 cm. Some were round and others irregular in shape. The right lung presented a similar aspect, but the nodules were more numerous and in certain areas coalesced. The suprarenal gland on the left side measured 3 x 6 cm. An oblong body, more or less caseous, was found herein which appeared tuberculous. Kidney measured 10 x 6 cm. The surface of the organ was studded with small, yellowish areas or bodies at the upper pole, contiguous with the suprarenal. The right suprarenal measured 3 x 4.5 cm. It presented on section a yellowish mass, which filled up the whole section of the organ and measured 1 cm. in diameter.

The diagnosis at first was that of pulmonary and pleural tuberculosis, pleural hemorrhage and tuberculosis of the suprarenals. A more careful examination of the sectioned lung surface showed the apparent tubercles to be at the same level with the surface, or even umbilicated. This point, together with their marked irregularity in shape and size, suggested a neoplasm with more or less miliary arrangement. The microscopic examination revealed the mesothelioma which was identical in its appearance in the sections from both suprarenals and both lungs. Harris recalls that Wooley and Adami described, in 1902, tumors appearing in both suprarenals similar to the case which he reported.

DISEASES OF THE SPLEEN AND BLOOD.

Rupture of Spleen. Four cases of this lesion are reported by Willis.¹²⁵ All the patients were males, and a blow on the left side of the body in splenic region was the etiological factor. The spleens were practically normal in size with short pedicles and without any previous history of disease of the organ. Rigidity and tenderness of the abdomen were present. One patient could not be operated upon because of coëxistent cerebral concussion. Three patients were operated upon within twenty-four hours of the injury. Each of these patients had complained of agonizing pain in the left shoulder which was promptly relieved following the splenectomy. In 2 of the cases a marked leukocytosis persisted after the operation over a period of from two to four weeks. These 3 patients had a satisfactory convalescence. One patient died eight days after operation. In this case there was a continuous fall in hemoglobin and a decreasing leukocyte count. In the first 2 cases operation was followed by direct transfusion, with apparently good results.

Rogers¹²⁶ reported an instance of rupture of an enlarged spleen. A laborer, after falling in a ditch, was admitted to the hospital with cramp-like pains in the left upper quadrant of the abdomen. General abdominal tenderness was present. Operation revealed large quantities of dark blood in the peritoneal cavity and a very large spleen with a rupture 6 cm. in length and 4 cm. in depth near the hilum. The spleen itself was 24 x 12 x 6 cm. and adherent posteriorly. Because of the adhesions, splenectomy was not attempted, the site of the rupture was packed with gauze. The gauze was removed on the fifth day and the patient made an uneventful recovery. Subsequent inquiry elicited a history of the malaria to which the splenic enlargement was ascribed.

Several days may elapse before rupture of the spleen becomes manifest clinically, as in the case of Walker's¹²⁷ patient who, though kicked by a horse in the upper abdomen, kept working for several hours. He then walked to the office of the doctor who found slight tenderness over the left upper abdomen and gave him some codein. He was put to bed and on the third day sat up for his meals and on the following day felt "something give way" in the upper abdomen. He went into a state of collapse. He was pallid and thirsty, abdomen distended, muscular rigidity on left side, especially in upper half. The abdomen at operation was found full of blood and the spleen ruptured. He died two days later.

An instance of apparent spontaneous rupture of the spleen is reported by Shorten¹²⁸ in the case of a soldier who was seized with a severe pain while walking about. Vomiting, muscular rigidity and free fluid in the abdomen suggested a rupture of an abdominal viscus. There were no localized symptoms. At operation the abdomen was found to contain a large quantity of fluid, and clotted blood, and a large rupture of the spleen was found. The spleen was removed and the patient recovered.

¹²⁵ Surgery, Gynecology and Obstetrics, 1919, p. 229.

¹²⁶ Journal of the American Medical Association, May 3, 1919, lxxii, 1615.

¹²⁷ Boston Medical and Surgical Journal, 1919, clxxx, 211.

¹²⁸ British Medical Journal, 1919, ii, 844.

Torsion of the spleen has been reported by Petridis,¹³⁹ Kopp¹⁴⁰ and Nijhoff.¹⁴¹ Petridis reports two patients, in one of whom the spleen contained a cancerous growth in the upper pole. In both instances the spleen was displaced toward the pubis, in one instance toward the right side becoming adherent to the appendix. Both patients recovered following a splenectomy. Kopp reports his experience and a review of the literature. The diagnostic features of splenic torsion are the sudden onset with intense pain and symptoms of peritonitis, the tumor developing in a few hours, its shape suggesting that of a large spleen, and the absence of the normal area of dullness over the spleen. There is no rigidity of the abdominal wall at first. He warns against reducing the torsion, with splenopexy, as the organ may have been too much damaged to recuperate. Splenopexy may be followed by recurrence; and reduction of the spleen, trusting to adhesions to fasten it in place, usually proves illusory.

Nijhoff's patient was seventy-two years of age and considered in good health until sudden abdominal pain, nausea and vomiting, and symptoms suggesting torsion of an ovarian tumor occurred. The incision revealed splenic torsion. Nijhoff states that splenectomy is relatively easier in difficult cases because of the longer pedicles than in normally located spleens.

Cysts of the Spleen. Splenic cysts present no group of symptoms which can be recognized as characteristic. The symptoms produced are referable to the increased size of the organ and the pressure on neighboring organs. Lambert¹⁴² reports an interesting case of non-parasitic cyst of the spleen which occurred in a woman, aged thirty-four years, whose chief complaint on admission was pain in the epigastrium, loss of weight and strength. The illness had started three years prior to admission and she had been under treatment for gastric ulcer. Twelve years previous to admission she had been rather severely bruised in an automobile accident and was confined to her bed for three weeks. Examination revealed no special localized signs. Operation was performed and the spleen removed; the patient made an uneventful recovery. Pathological report seemed to indicate that the cyst formation was the result of necrosis of an infarcted area. Lambert calls attention to the fact that the majority of cases seek a physician for the relief of pain. Gastric disturbances are frequent. No symptoms occur which point to disturbance in the splenic function. He also states that because of the fact that the majority of cases are not associated with dense adhesions, splenectomy has become the treatment of choice by most surgeons.

Tuberculosis of the Spleen. Tuberculosis of the spleen is rarely, if ever, strictly primary, although in patients in whom the original focus elsewhere has healed, or is exceedingly small, it may seem to be so. In this sense, so-called primary tuberculosis of the spleen is not exceedingly

¹³⁹ Lyon Chirurgical, Abstracted, Journal of the American Medical Association, June 14, 1919, 1796.

¹⁴⁰ Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, 1919, i, 379.

¹⁴¹ Ibid., ii, 183.

¹⁴² Annals of Surgery, 1919, lxi, 15.

rare. Giffin¹⁴³ reports 4 cases of tuberculosis of the spleen. In the first instance the lesion produced an anemia of a hemolytic type analogous in many respects to that of pernicious anemia and hemolytic jaundice. Three years after splenectomy the patient is well and will likely prove to be a permanent cure. The second case was not unlike the first. Giffin concludes that: Splenectomy is indicated in cases of more or less definitely localized tuberculosis of the spleen. From the standpoint of diagnosis, tuberculous splenitis should be considered in every case with marked splenomegaly in which the findings are not clearly those of some other disease. Primary tuberculosis of the spleen may simulate pernicious anemia. The coincidental association of tuberculosis with diseases of the spleen and blood will explain a certain small percentage of atypical cases.

Spleen in Trench Fever and Infectious Diseases. Swift¹⁴⁴ states that the enlarged spleen found in trench fever is harder than that found in typhoid fever and not so large as that often present in malarial fever. This finding is important to keep in mind in view of the fact that typhoid and malarial fever may be mistaken for this disease. The occurrence of splenic enlargement in infectious diseases has always given rise to the belief that the spleen played some part in the defensive reaction of the organism to infection. Morris and Bullock¹⁴⁵ conducted experiments on splenectomized rats in order to arrive at some conclusion as to the importance of the spleen in opposing infection. The result showed that while these animals may get along fairly well without the spleen in the absence of any infection, the reverse is true when bacterial invasion occurs. The authors believe that the spleen plays a very important part in resisting infectious processes and its removal temporarily robs the body of its influence until such time, at least, as other organs would have the chance to compensate.

Splenic Anemia. Bacteriological studies of the removed spleen in Banti's disease are reported by Kristjanson¹⁴⁶ and Lemaire.¹⁴⁷ The former discovered a coccus which, when inoculated into dogs, produced fever and leukocytosis and a progressive enlargement of the spleen with fibrosis and perisplenitis. The histologic changes in the spleen were not unlike those occurring in early Banti's disease. Control animals inoculated with other organisms, such as staphylococci, colon bacilli, etc., showed symptoms of a general infection but no progressive fibrosis of the spleen. Lemaire inoculated monkeys with scraps from the spleen from a case of primary splenomegaly which had been fatal in five months, and these animals developed a similar febrile and fatal disease with anemia, leukopenia and mononucleosis.

Castaldi¹⁴⁸ describes a case of Banti's hemolytic splenomegaly observed in a man, aged twenty-seven years. There was no pain and but little jaun-

¹⁴³ Medical Clinics of North America, 1919, iii, 765.

¹⁴⁴ Journal of the American Medical Association, 1919, lxxiii, 807.

¹⁴⁵ Annals of Surgery, 1919, lxx, 513.

¹⁴⁶ Wisconsin Medical Journal, 1919, xviii, 125.

¹⁴⁷ Bulletins de la Société Médicale des Hôpitaux, Paris, 1919, xliii, 599.

¹⁴⁸ Rivista Critica di Clinica Medica, Florence, 1919, xx, 325; Abstract, Journal of the American Medical Association, October 11, 1919, 1167.

dice accompanying the intense anemia. The blood count showed 2,105,000 red and 6305 white corpuscles, hemoglobin 45 per cent., and the color index 1.07, with 53.5 per cent. polynuclears; 0.5 per cent. eosinophils, and basophils 4 per cent.; large mononuclears 4 per cent., and 41.5 per cent. lymphocytes; no myelocytes and no nucleated erythrocytes. As no improvement was realized under medical measures, Castaldi advised splenectomy, but the patient refused this and roentgen treatment was applied, with brilliant success. Ten exposures of ten minutes each were given in the course of forty-five days and the outline of the spleen subsided from 21 by 16 to 12 by 11.5, while the hemoglobin increased to 80 and the erythrocytes to 5,600,000; the weight increased by nearly 5 kg. The patient would not wait for further treatment but has kept well during the four years since, including nearly three years of military service. The case teaches the necessity for a trial of thorough roentgen treatment before resorting to splenectomy in such cases.

The Gaucher type of splenomegaly was first described in 1882, since which time a number of cases have been reported. Carr and Moorhead¹⁴⁹ have recently added another case to the literature. The patient, whose case history in abstract follows, presented characteristic clinical features and is the oldest patient a victim to the disease as yet reported. In addition he has remained well twenty-one months after splenectomy, which is the longest time elapsing after operation as yet reported. A man, aged forty-six years, had known since childhood of a tumor in the left side of his abdomen. Attention was first directed to this when he was nine years of age. The tumor gradually increased in size, though the patient's general health was always good. The tumor produced neither pain nor tenderness, but at the time of entrance to the hospital, the patient was suffering from difficulty of respiration, which was sufficiently severe to prevent the discharge of his daily work. The patient was very emaciated, and yellowish looking. Examination was generally negative except so far as it concerned the emaciation, the abdominal findings and the blood. There was no general adenopathy. The heart was normal except for a soft systolic blowing murmur, heard at the base. The abdominal tumor was determined to be the spleen. It extended to within 5 cm. of the symphysis pubis, and beyond the median line to 5 cm. to the right of the umbilicus. It was hard, smooth and not tender. The liver was palpable 10 cm. below the costal arch. The lower extremities were moderately swollen. Blood examination revealed: Hemoglobin 35 per cent.; erythrocytes 2,240,000; leukocytes 3200. A second count was practically the same, the leukocytes, however, being only 2100. There was no increased fragility of the red cells; poikilocytes and microcytes were present, and three normoblasts were noted in one of two examinations. Differential white count revealed: Small mononuclears, 17; large mononuclears, 12; polymorphonuclears, 68; eosinophiles, 1; transitionals 1; myelocytes, 1.

There was no history of previous illness, other than this one. Venereal disease was denied. Family history was negative. The Wassermann

¹⁴⁹ Journal of the American Medical Association, 1919, lxxii, 19.

test was negative. The diagnosis of Banti's disease was made, and the case was regarded as probably of the Gaucher type. Subsequently, a spleen 11 pounds in weight was removed. The liver showed a fatty and atrophic cirrhosis. Transfusion was done, 600 c.c. each time, before the operation and on the day following. On the day after the operation the blood count revealed: Hemoglobin, 70 per cent.; erythrocytes, 6,150,000; leukocytes, 2900; differential white count: polymorphonuclears, 86; no abnormal red cells. Four days later, the hemoglobin was 70 per cent.; erythrocytes, 5,350,000; leukocytes, 1920. On section, the spleen showed large irregular alveolar spaces, representing the greatly dilated venous sinuses, filled with the peculiar large cells with nuclei relatively small, sometimes single, sometimes multiple, characteristic of the Gaucher type of splenomegaly. An iron-containing pigment was found between the connective-tissue fibers of the trabeculae. The patient made an uneventful recovery and left the hospital in three weeks.

Idiopathic Splenomegaly of Childhood. Two clinical types of splenomegaly in childhood are the only ones to be included in the term idiopathic, according to the editor of the *Medical Record*, May 10, 1919, 785; the first of these is *splenic lymphadenia without leukemia*. The onset of the affection is insidious, the patient is pale and weak. There is anorexia, with vague abdominal pain, and finally a tumor will be discovered in the left side of the abdomen. Hypertrophy of the spleen is now an accomplished fact and the phase of full development is reached. The digestive disturbances become more accentuated. Blood examination shows a considerable decrease in the number of red cells without any increase of the whites. Soon the lymphatic system becomes involved in the process; the lymph nodes of the neck, groin, axilla, mesentery, and the mediastinum become hypertrophied with all the consequent symptoms of compression. Later on, nervous and psychic disturbances ensue, the urine becomes dark in color and hemorrhages are frequent. The patient dies in cachexia and anemia after a lapse of several years. This symptomatology is unquestionably that of a serious form of anemia; but the splenomegaly precedes the blood changes, therefore it is not the consequence. The splenomegaly is the direct cause of the anemia, while blood examination shows numerous changes and deformities of the red cell unknown in essential anemia.

The second form of *idiopathic splenomegaly*, discussed by the editor of the *Medical Record*, is the so-called primary form described by Debove and Bruhl. The onset is also insidious, with a sensation of weight in the left hypochondrium. It rarely begins suddenly with a visceral paroxysm or with general phenomena, such as asthenia, emaciation, and dyspeptic disturbances. Two principal symptoms occupy the stage, namely, splenomegaly and anemia with all the train of phenomena relating to each. The liver is increased in size, while pleuro-pulmonary accidents are common. The affection is apyretic and hemorrhages are multiple. Blood examination shows a considerable decrease in the number of red cells, as well as in the percentage of hemoglobin. The terminal phase of the process is marked by advanced cachexia, anasarca, nervous disturbances, albuminuria, and hemorrhages. The

evolution of the affection occupies from three to four years or even more. In this process the symptomatology might be regarded as that of a high grade anemia, but here also the splenomegaly precedes the anemia. What also differentiates the primary splenomegaly of Debove and Bruhl from splenic lymphadenia without leukemia is the integrity of the lymphatic system.

Hemolytic Splenomegaly. Gilbert¹⁵⁰ records the case of a patient who was noticed to be jaundiced at the age of two years and developed splenic enlargement at the age of sixteen. Since that time jaundice has developed in waves with greatest intensity in the winter time. At thirty-three years of age anemia had become quite marked, with a reduction in the red cells to 1,900,000. It was apparently gradually approaching the type of pernicious anemia. No enlargement of the liver was detected. Following the removal of the spleen the jaundice disappeared and the blood picture returned to approximately normal in two months, with restoration of health. In contradistinction to this type is the so-called *acholuric jaundice* with urobilinuria, but with no signs of cholemia. The jaundice is the minor symptom, the main features being the enlargement of the spleen and the fragility of the red cells. It exists frequently in a congenital and familial form. Ceconi¹⁵¹ records 2 patients who presented this chronic acholuric jaundice with great enlargement of the spleen, and in whom the familial investigation revealed 16 members affected of the 60 members in three or four generations studied. Hemolysis is the essential feature, and this has been combated by removal of the spleen which seems to be responsible for the excessive production of hemolysins. In the few cases in which splenectomy has not produced a cure, it is supposed that the bone-marrow may be involved. Ceconi prefers the term "hemolytic splenomegaly" instead of hemolytic jaundice because of the inconstancy of jaundice.

Blood Transfusion. During the past four or five years blood transfusion has become a popular therapeutic measure. Many of the older writers speak of its use in centuries past, but in recent times it had fallen largely into disuse until the present revival. A Swiss writer,¹⁵² for example, states that Cardanus, in 1556, suggested transfusion of blood from a person of good character in the hope to redeem the character of the otherwise hopelessly immoral. The same writer states that, in 1667, cases were reported in which blood from a lamb was infused with the recovery of moribund patients. Many other interesting data with regard to the history of transfusion may be found. Today, the use of blood transfusion presupposes a knowledge of its indications, the selection of a suitable donor, the technical skill and a knowledge of the different methods, for example, the use of whole blood, or of blood treated with sodium citrate.

The indications for blood transfusion have been tabulated by Garbat¹⁵³ as follows:

¹⁵⁰ Bulletins de la Société Médicale des Hôpitaux, Paris, 1919, xliii, 789.

¹⁵¹ Journal of the American Medical Association, June 7, 1919, 1709.

¹⁵² Correspondenz-Blatt f. Schweitzer Aertz, 1919, xlix, 992.

¹⁵³ Journal of the American Medical Association, 1919, lxxii, i.

1. To replace blood in hemorrhage of all kinds:
 - (a) During the act of bleeding (and at the same time also to help stop the bleeding).
 - (b) After the bleeding has stopped and an anemia with its sequelæ remain.
2. To stimulate the blood-forming organs in blood diseases:
 - (a) Pernicious anemia.
 - (b) Leukemia.
3. To alleviate or cure hemorrhagic conditions:
 - (a) Hemophilia.
 - (b) Hemorrhagic diseases of the newborn.
 - (c) Purpuras.
 - (d) Complicating secondary hemorrhagic diseases, as jaundice, grave anemia and infections.
4. To act as a stimulant or tonic:
 - (a) Before operations.
 - (b) In debilitated conditions.
 - (c) In acute shock.
5. To neutralize or overcome effects of poisons:
 - (a) Bacterial infections.
 - Bacteremia.
 - Endocarditis.
 - Infections with pyogenic bacteria; typhoid, etc.
 - Toxemia only:
 - Diphtheria.
 - Peritonitis, etc.
 - (b) Chemical:
 - Diabetic coma.
 - Acute gas poisoning.
 - Acute yellow atrophy of the liver, etc.

The first indication stated above represents a condition in which blood transfusion is the ideal form of treatment. As Unger¹⁸⁴ states, it serves not only to replace loss of blood but also to check actual bleeding. In *acute hemorrhages*, the results are naturally more brilliant than in less fulminating bleeding. In about 85 per cent. of the cases of acute hemorrhage, bleeding can be stopped by one transfusion. Its value in the blood diseases—pernicious anemia and leukemia—is discussed under these headings.

With regard to *hemophilia* and the *bleeding of the newborn*, Unger states as follows: Hemophilia is not cured by transfusion; but for the bleeding of hemophilia, it is practically a specific. It will succeed when all other methods fail. Valuable time should therefore not be lost in attempts to control bleeding by other methods, since we have at our command a specific that will not only control the hemorrhage but also replace the lost blood.

In bleeding of the newborn, transfusion is a specific. An almost exsanguinated infant, too weak to cry and in a dying state, is trans-

¹⁸⁴ Journal of the American Medical Association, 1919, lxxiii, 815.

formed immediately into an apparently healthy, rosy and crying baby. As in hemophilia, it will save the lives of those who are not helped by subcutaneous injections of serum or blood. Temporizing by using less effective measures may cost the baby's life. This is especially true in cases of melena neonatorum, which are the most serious because we do not know just when the hemorrhage began or how much internal hemorrhage is taking place. Just as soon as the diagnosis of bleeding from the stomach or the bowel of the newborn is made, transfusion should be performed.

A striking illustration of the value of blood transfusion in these cases is reported by Lowenburg.¹⁵⁵ An infant two days old was admitted to the hospital with profuse uncontrollable bleeding from the mouth, nose and rectum. The patient was apparently moribund when it was decided to apply blood transfusion *via* the longitudinal sinus. The head was shaved, sterilized with iodine, and about 80 c.c. of whole human blood injected into the longitudinal sinus *via* the posterior angle of the anterior fontanelle. After transfusion the baby's color appeared better, bleeding stopped and although a second transfusion was contemplated it proved unnecessary. The child promptly improved, the blood count changing from the admission, March 5, 1919, to April 1, 1919, as follows: Hemoglobin, 20 to 80 per cent.; red blood cells, 1,400,000 to 3,600,000; white blood cells, 12,000 to 8200.

The value of *transfusion in gas poisoning* is illustrated in the following case from Lindeman's¹⁵⁶ experience. A girl, aged eighteen, in January, 1915, was exposed to illuminating gas while asleep in her room, from midnight until 6 A.M. A gas pipe had exploded and the gas had escaped through a small hole in the floor of the room in which she slept. The window and the door of the room were closed. Lindeman saw the girl thirty-six hours after her exposure. She was then in deep coma, and there was a general rigidity, more on the right side than on the left, with no response to reflexes except the corneal reflex. One thousand four hundred c.c. of blood were removed, and 1100 c.c. were transfused. The performance was repeated thirty-six hours later. She then began to show gradual signs of improvement. The rigidity grew less; she began to take nourishment when spoon-fed; reflexes returned and were exaggerated, with ankle and patella clonus. Consciousness, however, was not regained until the eleventh day after her exposure. After that her improvement was uninterrupted, and within two months she recovered completely, with no paralysis or mental disturbance. A severe acne vulgaris, which had existed for several years, cleared up after her transfusion.

The *selection of a suitable donor* is not a simple matter. In the *first* place the possibility of transmitting disease must be carefully considered. Thus, Gubb¹⁵⁷ reports a case of accidental transference of the malarial parasite in the course of transfusion. Ramirez¹⁵⁸ reports a case

¹⁵⁵ Journal of the American Medical Association, 1919, lxxii, 1615.

¹⁵⁶ Ibid., 1919, lxxiii, 896.

¹⁵⁷ British Medical Journal, 1919, ii, 74.

¹⁵⁸ Journal of the American Medical Association, 1919, lxxiii, 984.

in which horse asthma occurred following transfusion. The donor had been a subject of long-standing asthma and bronchitis and reacted to the protein test for horse dandruff.

In the *second* place, and of equal importance, is the selection of a donor whose blood corpuscles are compatible with the serum of the recipient. Isohemagglutination, as this is called, is an interesting biologic phenomenon. It has been found that all persons may be classified in one of four groups, according to whether or not they have in their serums isoagglutinins of a certain type. Various diagrams of the blood groupings have been presented. Lyon¹⁵⁹ presents another diagram as follows:

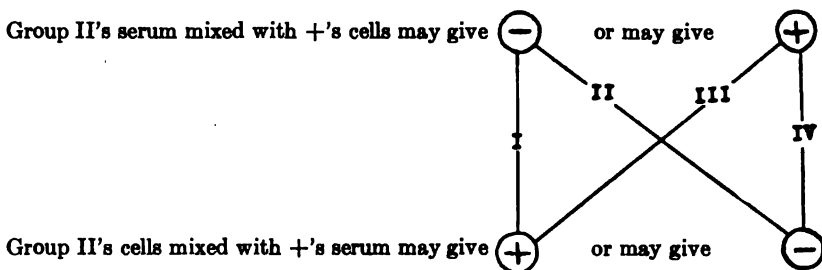


FIG. 74.—Diagram indicating the blood group of an unknown person, X, by inter-agglutination of X's serum and cells with those of an individual of known Group II: + indicates agglutination of cells; —, absence of agglutination. The possible combinations are indicated by connecting lines and the blood group of X by the Roman numerals inserted in the connecting lines.

Lyon states that the several diagrams previously published show the interrelations of the human isohemagglutination groups, and the manner of determining the group to which any person belongs by the use of serum obtained from persons of Group II and III. By using both cells and serum of a person of Group II (or III) and those of an unknown person it is nearly as easy to determine the group to which the unknown person belongs as it is with serum of known II and III groups. While this fact has been long appreciated, so far as Lyon is aware it has never been expressed diagrammatically. The diagram herewith is an attempt to do so.

In case the determination is to be made with a known III person, III should be substituted for II in the diagram and II for III. As about half of all persons fall into either Group II or Group III, it is obvious that about half of all persons interested in blood grouping carry with them several hundred cubic centimeters of essential reagents for determining the blood groups of unknown persons.

The various *methods of transfusion* utilize either whole blood or citrated blood. Both of these methods have their ardent advocates. At Bernheim's¹⁶⁰ suggestion, the Medical Department of the American Expeditionary Forces adopted the sodium citrate method. According to Fleming and Porteus,¹⁶¹ who report the result of their observations on

¹⁵⁹ Journal of the American Medical Association, 1919, lxxiii, 498.

¹⁶⁰ Ibid., lxxiii, 172.

¹⁶¹ Lancet, 1919, cxcvi, 973.

100 cases of transfusion at a base hospital, the *citrate method* has the following advantages over other methods:

1. (a) It should never be necessary to cut down on the vein of the donor. (b) Only seldom should it be necessary to cut down on the vein of the recipient. (c) The donor need not be brought into the presence of the recipient, but the blood can be taken in the most convenient place. (d) The apparatus required can readily be improvised.

2. In the opinion of workers who have had extensive experience of several methods the results obtained by the citrate method are as good as those of any of the more complicated and difficult methods.

3. The transfusion of citrated blood on many occasions saved or prolonged life.

4. Blood transfusion can be repeated frequently if necessary.

5. The administration of citrated blood has no effect in diminishing the coagulability of the recipient's blood.

Garbat¹⁶² studied 100 cases in which sodium citrate transfusion was performed for various disturbances and concludes that the favorable results obtained compare almost absolutely with those obtained by other authors using unmixed blood. He believes that except in special instances it should be adopted as the routine procedure. A frequent objection raised to the sodium citrate method is that marked reactions are obtained after this mode of transfusion. In Garbat's series of 100 cases, reactions were noted as follows:

(a) Forty-eight per cent. were associated with no reaction whatever; no abnormal manifestations either subjectively or objectively were noted.

(b) Ten per cent. had practically no reaction to speak of. There was a rise in temperature of 1° or 2° for several hours, but the patient has no abnormal subjective sensations.

(c) Forty-two per cent. showed a definite reaction consisting of chilly sensations or chills, and fever; and in the severest type, vomiting. Of the 42 per cent.: There was a rise of temperature up to 103° to 105° in eight. There was a rise of temperature up to 102° to 103° in nineteen. There was a rise of temperature up to 101° to 102° in fifteen.

Drinker and Brittingham¹⁶³ conclude from their experience that while no method of transfusion is reaction free, the citrate method gave a larger number of reactions than are reported in the experience of others. Out of 83 transfusions they have had a rise in temperature of 2.5° fifty times, or 60 per cent., and of this number 39, or 47 per cent., have had chills. These figures include all the transfusions of whole citrated blood which have been done by different individuals at the Brigham Hospital. In order to test the matter further, they have done seventeen such transfusions, using the most extreme care in the effort to reduce the reaction percentage. In these transfusions there were 9 rises in temperatures above 2.5°, or 53.3 per cent., and 7 chills, or 40 per cent. Removal of the plates and a comparable number of white cells by defibrination, with thorough washing and suspension of the red cells in

¹⁶² Journal of the American Medical Association, 1919, lxxii, 1.

¹⁶³ Archives of Internal Medicine, 1919, xxiii, 133.

similar saline solution has resulted in 20 per cent. of reactions in fifteen transfusions. Addition of citrate from one to two hours before injection to transfusing blood so prepared has resulted in 44 per cent. of reactions in nine transfusions.

While the totals of the different types of transfusions which have been employed are not large, it appears that three elements make up the final total of reactions in citrate transfusion: (a) Very rare gross incompatibilities which escape *in vitro* detection; (b) changes in the plates, part of the process of coagulation; (c) direct action of the sodium citrate on red cells promoting hemolysis.

■ Pemberton¹⁶⁴ reports a series of 1036 transfusions performed on 429 patients. Five were done by means of the paraffin-lined cylinder, 30 by a modified cannula-syringe technic, and the other 1001 by the citrate method. The cases are grouped according to indications for transfusion: Primary (pernicious) anemia, 657 transfusions in 185 cases. Secondary anemia, 243 transfusions in 149 cases. Bleeding, 81 transfusions in 59 cases. Acute toxic and septic conditions, 34 transfusions in 25 cases. Leukemias, 20 transfusions in 10 cases. Shock, 1 transfusion in 1 case. In 219 transfusions (21 per cent.) of the series, there occurred from fifteen minutes to one hour later a slight reaction of chill and fever, a temperature of 100° to 105° F., with or without malaise, headache, nausea and vomiting and diarrhea, and followed in a small percentage of cases, on the third day after transfusion, by an eruption of herpes. In another 15 per cent. of transfusions there occurred a rise of temperature to 100° F. or above, not associated with chill and nausea. These were, in every instance, of a transitory nature, the temperature returning to normal in from twelve to thirty hours, and in only two instances was it at all probable that the good of the transfusion was vitiated by this complication.

These reactions occur early after the introduction of 50 or 100 c.c. of blood; the patient first complaining of tingling pains shooting over the body, and a fulness in the head and an oppressive feeling about the precordium, and, later, an excruciating pain localized in the lumbar region. Slowly but perceptibly the face becomes suffused, a dark red to a cyanotic hue; respiration becomes somewhat labored, and the pulse-rate, at first slow, sometimes suddenly drops as many as 20 to 30 beats a minute. The patient may lose consciousness for a few minutes. In one-half of the cases an urticarial eruption, generalized over the body or limited to the face, appeared along with these symptoms. Later, the pulse may become very rapid and thready; the skin becomes cold and clammy, and the patient's condition is grave. In from fifteen minutes to an hour, a chill occurs, followed by high fever, a temperature of 103° to 105° F., in which the patient may become delirious. Jaundice may appear later. The macroscopic appearance of hemoglobinuria is almost constant. In three such instances the symptoms were not recognized at the time of the transfusion, and 500 c.c. of blood were injected. All the patients died, two in one and three hours, respectively, following

¹⁶⁴ Surgery, Gynecology and Obstetrics, 1919, xxvii, 262.

the transfusion, and one became comatose shortly afterward and died thirty hours later. In the other nine instances the symptoms were early recognized and interpreted, and the transfusion was concluded after the injection of 50 to 100 c.c. of blood. Epinephrin and atropin were administered with good effect. There was no mortality in this group.

The cases point out most strikingly the fact that the injection of incompatible blood, namely, in which the donor's cells are agglutinable by the serum of the patient, is attended by the development of symptoms of the gravest nature, and that if these are not early recognized and the transfusion concluded before the injection of a large quantity of blood, fatal results are to be expected.

Lewisohn¹⁶⁵ performed 200 transfusions using citrated blood for the following conditions with the results noted: (a) Hemophilia and allied conditions, 14 cases, 15 transfusions; 11 cures, 3 deaths; (b) purpura hemorrhagica, 16 cases, 20 transfusions; 4 cures, 5 improved, 2 results unknown, 5 deaths; (c) gastro-intestinal hemorrhage, 11 cases, 20 transfusions; 2 cures, 1 improved, 8 deaths; (d) cholemia, 5 cases, 11 transfusions; 5 deaths; (e) postoperative hemorrhages, 13 cases, 16 transfusions; 6 cures, 7 deaths; (f) hemorrhages from the female genital organs, 2 cases, 2 transfusions; 2 deaths; (g) traumatic hemorrhages, 2 cases, 3 transfusions; 1 cure, 1 death; (h) pernicious anemia and leukemia, 24 cases, 39 transfusions; 7 improved, 4 not improved, 13 deaths; (i) primary and secondary anemia, 4 cases, 7 transfusions; 3 cures, 1 improved; (j) preoperative and postoperative transfusions, 35 cases, 39 transfusions; 12 cures, 23 deaths; (k) sepsis, 5 cases, 7 transfusions, 5 deaths; (l) incurable conditions (transfusions performed at request of family) 12 cases, 12 transfusions; 12 deaths; (m) general debility, 6 cases, 8 transfusions; 1 improved, 1 result unknown, 4 deaths; (n) acute poisoning, 1 case, 1 transfusion, 1 cure.

Lindeman¹⁶⁶ reports the performance of 214 consecutive whole blood transfusions without a chill by a method which he describes and calls the syringe-cannula system. The following is the description of the method which he has devised: The entire apparatus consists of six syringes, two tourniquets, and two sets of cannulas.

Cannulas. Two sets of cannulas are employed, one for the donor, the other for the recipient (Figs. 75 and 76).

There are three cannulas, to each set (Fig. 76, 1, 2 and 3). Each cannula telescopes within the other as shown in Fig. 75.

The innermost cannula is practically a hollow needle, $2\frac{6}{8}$ inches long, 30-gauge, with one end ground to a fine point and short bevel. The hollow needle (Fig. 76, 1) is fitted snugly into Cannula 2. Cannula 2 is 5 mm. shorter than the needle and is fitted snugly into Cannula 3. Cannula 3 is 5 mm. shorter than Cannula 2. The proximal ends of Cannulas 1 and 2 are capped with stationary thumbscrew caps. The proximal end of Cannula 3 is capped with a receiver to fit any Record syringe.

Cannula 3 is two inches long, 14-gauge, 0.064 diameter. The caliber of this cannula is the same as the tip of a Record syringe.

¹⁶⁵ American Journal of Medical Science, 1919, clvii, 253.

¹⁶⁶ Journal of the American Medical Association, 1919, lxxii, 1661.

In very small infants with very small veins only Cannulas 1 and 2 are employed, Cannula 2 being capped with the receiver to fit the tip of the syringe.

The syringes can be sterilized in 95 per cent. alcohol for a period of ten minutes and then rinsed in physiologic sodium chloride solution to remove the alcohol.



FIG. 75.—A, distal end of cannula 2; B, distal end of cannula 3.

Operation. The patient and the donor are placed in recumbent posture in parallel position. The skin of the arms is sterilized. A small table is set between the patient and the donor. On this table are placed three basins containing sterile physiologic sodium chloride solution approximately room temperature, for the washing of syringes. A nurse stands behind the table and washes the syringes by rinsing each syringe

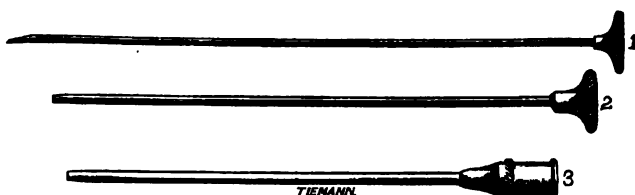


FIG. 76.—1, innermost cannula, or hollow needle; 2, middle cannula; 3, outer cannula.

in each one of the three basins. As long as the last rinsing basin contains sterile normal salt solution, the other two may contain sterile tap or distilled, water or salt solution. A syringe is never used a second time until washed in these basins, hence no old or residual blood is allowed to enter the patient. These syringes are washed as rapidly as they are used. The third rinsing basin should remain clear throughout the operation.

One operator manages the syringe of the donor, the other operator that of the recipient. A tourniquet is placed on the arm of the patient to distend the vein. A cannula is then inserted into the vein by a skin puncture only.

Insertion of Cannula. When the needle has entered the vein, a drop of blood is seen to trickle from the distal end of the innermost cannula. After the first joint A has entered the vein, Cannula 1 is withdrawn about one-half inch, thus preventing the vessel wall from being punctured or injured by the needle after the vein is entered.

With the thumb now on the screw-cap of Cannula 2, the cannula is forced further until joint B has entered the vein. Cannula 2 is then withdrawn a distance of one-half inch, Cannula 3 alone now coming in contact with the vessel wall. The latter is then gently pushed into the vein to a desirable length, usually from three-quarters to one inch. The tourniquet is then removed.

A cannula is then inserted into the vein of the donor in a similar manner. The tourniquet is placed on the arm sufficiently tight to obstruct the venous return, but not tight enough to impede the arterial flow, and the remains on the arm of the donor throughout the operation. Everything is now in readiness for transfusion. There is no need of haste at this stage.

The obturator in the cannula of the donor is removed and an empty syringe is promptly attached and blood is withdrawn as rapidly as possible. When the syringe is filled, the assistant replaces it by an empty syringe, at the same time placing the filled syringe on the table. The operator places his thumb over the mouth of the cannula to prevent leakage during change in syringes.

The operator on the recipient picks up the filled syringe, attaches it to the cannula after removing the obturator, and evacuates the contents gently but speedily into the vein. As soon as the contents are evacuated a full syringe is again ready for evacuation. One syringeful of blood follows another in rapid succession until the desired quantity of blood has been transfused.

Small syringes of 20 c.c. capacity are found most satisfactory. Larger sizes are not used because it requires a longer time to fill and empty them. The time elapsing for the filling and emptying of one syringe is from six to ten seconds. It is practically impossible for any chemical or physical change to take place in that short space of time. Since the blood is transplanted in relay fashion, the entire mass of blood, regardless of the amount, is outside the body only so long as it takes to fill and empty one syringeful, namely, from six to ten seconds.

A little of the salt solution is squirted around the cannula occasionally to keep the field clean but none is injected into the vein of the patient.

CONCERNING THE LIFE OF THE TRANSFUSED RED BLOOD CELL. Ashby¹⁸⁷ has contributed some interesting data on the length of life of the transfused red blood corpuscles in man. The method used depends upon the fact that corpuscles belonging to two different blood groups can be separated, after mixing, from one another by treating with serum that will agglutinate one of the groups. It is not within the province of this review to go into the details of Ashby's technic which is found in his articles. The results, however, are germane. The following tabulation of ten cases is self-explanatory:

Case.	Sex.	Age.	More than 90 per cent. of transfused cor- puscles remain- ing after.	From 80 to 60 per cent. of transfused cor- puscles remain- ing after.	From 50 to 40 per cent. of transfused cor- puscles remain- ing after.
1	F.	35	24 days	26 days	28 days
2	F.	32	12 "	33 "	?
3	F.	32	14 "	28 "	29 "
4	F.	45	21 "	32 "	34 "
5	M.	32	22+ "	?	?
6	M.	42	24 "	32 "	?
7	F.	32	34 "	35 "	46 "
8	F.	39	17 "	32 "	52 "
9	M.	50	26 "	35 "	
10	M.	33	20+ "	30 "	

¹⁸⁷ Journal of Experimental Medicine, 1919, xxix, 267, and Medical Clinics of North America, 1919, iii, 783.

Finally, it may be said that the use of transfusion in civilian practice will probably be greater in the next few years than it has in the past because of the experience which a number of men have gained while using it in the army. As Bernheim states, "A brilliant page in the history of blood transfusion was written in France." Physicians who wrote it there will no doubt expand the chapter here.

Erythremia. Ever since 1903, when Osler called attention to this condition which was originally described by Vaquez in 1892, considerable interest has been manifested in its cause and symptoms. It is characterized by an increase of the total bulk of the blood, an increase in the number of red blood cells, an increased viscosity of the blood, enlargement of the spleen and cyanosis. The primary lesion is considered to involve the erythroblastic tissues of the bone-marrow, just as leukemia involves the leukoblastic elements.

Goyena and Masoch¹⁶⁸ report an interesting example of Vaquez's disease in which the enlargement of the spleen was the first evidence of the condition. Three years later there developed typical erythremia, in which the red cells increased from 4,510,000 to 8,400,000 while under observation.

Fraser's¹⁶⁹ patient had noted for many years blueness of the face and hands, especially during cold weather, and occasional epistaxis. Eighteen months before coming under observation she observed swelling of the abdomen and other symptoms—*e. g.*, frontal headache, a feeling of fulness in the head, pain in the upper abdomen, and some loss of flesh. When admitted to the South London Hospital for Women in February, 1918, there was congestion and cyanosis of the skin of the face, ears and neck, the mucous membrane of the mouth and tongue was purplish in color, and the conjunctivæ were injected. Discoloration of the forearms and hands was present and some dilatation of the veins of the legs. The arteries were thickened, the blood-pressure measured 128 mm. Hg.; the heart was normal. A blood examination gave the following result: Red blood cells, 9,510,000 per c.mm.; white blood cells, 30,000; hemoglobin, 130 per cent.; color index, 0.7. A differential count gave, in per cent.: Polymorphonuclear cells, 86.8; lymphocytes, 8.6; hyaline cells, 1.4; eosinophiles, 1.5. No abnormal cells were seen. The liver was enlarged, the edge being palpable 3 inches below the costal margin in the mid-clavicular line. The spleen formed a hard, somewhat nodular mass in the left hypochondrium, extending to the level of the umbilicus. There was no evidence of organic kidney disease.

Warthin¹⁷⁰ observed a case of erythremia with chronic cyanosis, and shortness of breath observed over a period of five years. It was at first thought to be a mediastinal tumor, but was later recognized as erythremia. The clinical course was characterized by attacks of angina, cyanosis, increasing weakness, drowsiness, edema, asthma, dyspnea, enlargement of the spleen and liver, multiple telangiectasis, and constant erythremia.

¹⁶⁸ *Semana Medica*, Buenos Aires, 1919, xxvi, 113; Abstract, *Journal of the American Medical Association*, 1919, lxxiii, 1735.

¹⁶⁹ *Lancet*, 1919, cxcvi, 338.

¹⁷⁰ *Journal of the American Medical Association*, 1919, lxxiii, 716.

The man was fairly comfortable for some time but finally developed large spleen and liver, and very marked somnolence, which was in accord with the Spanish description of the disease (Ayerza's disease).

At the postmortem examination the findings were: Extreme atherosclerosis of the pulmonary artery and all its branches, extreme dilatation of the right heart, fibrosis and emphysema of the lungs, extreme angiectasia of the entire vascular system, enlargement of the liver and spleen, and hyperplasia of the bone-marrow. The microscopic examination revealed the presence of a typical syphilitic mesarteritis of the pulmonary artery and aorta, chronic fibroid myocarditis, pancreatitis, orchitis, leptomeningitis, suprarenal infiltration of plasma cells, and also changes in the stomach wall of a syphilitic character.

Naville and Brutsch¹⁷¹ report 4 cases. They believe the disease is primarily due to a hyperfunction of the bone-marrow. The treatment is purely symptomatic in the present stage of our knowledge. Splenectomy is contra-indicated. They recommend a diet restricted to milk and vegetables, a diet relatively low in food value. Venesection and the use of sodium citrate to reduce the viscosity of the blood might be employed. The x-rays applied to the spleen and bone-marrow may be of value. Among the various drugs the iodides, nitrites, salicylates, spleen and bone-marrow might be tried.

Marsh¹⁷² reports 15 cases observed in the Mayo Clinic since 1911. Ten of the cases occurred between the ages of forty-five and fifty-six; the oldest patient was sixty-two and the youngest twenty years. Thirteen of the fifteen patients were males. In addition to the symptoms ordinarily associated with erythremia, Marsh calls attention to the frequency of nervous symptoms. Eight of his patients gave such symptoms as their chief complaint. The most common was headache. Other nervous symptoms complained of were dizziness in 5 cases, auditory disturbances in 2, nervousness in 3, insomnia in 1, disturbances of vision in 2, loss of energy in 3, numbness of the extremities in 2, loss of memory in 1, and paralysis in 2. In the early stages such symptoms must result from simple circulatory disturbances, and in the later stages from cerebral hemorrhage or thrombosis. Other general symptoms noted were epigastric and left hypochondriac pain, palpitation, anorexia, dyspnea, indigestion, diarrhea, and pain in the back. Marsh states that hemorrhage of varying severity is common. It was mentioned in 10 of the case histories; in the other 5 it was not definitely stated that bleeding had not occurred. Hematemesis was noted in 1 case, hematuria in 1, hemoptysis in 2, melena in 3, bleeding gums in 2, epistaxis in 3, menorrhagia in 2, cerebral hemorrhage in 2, and prolonged bleeding after extraction of teeth in 1. As was to be expected, the patient's general condition usually improved following a hemorrhage.

Eye examinations were made in 13 cases. In 8 definite changes were found; the most common finding was the presence of dark colored, dilated, tortuous, retinal veins. Large dark retinal veins were found in

¹⁷¹ Schweizer Archiv f. Neurol. und Psychiatrie, Zurich, 1919, iv, 88; Abstract, Journal of the American Medical Association, 1919, lxxii, 1798.

¹⁷² Medical Clinics of North America, 1919, iii, 741.

4 cases, slight venous engorgement with hyperemia of the nerve head in 1 case, small retinal hemorrhages in 1, tortuosity of retinal vessels in 1, increased haze of nasal side of disk in 1, and choked disk in 1. The presence of a choked disk in a case of polycythemia often leads to the mistaken diagnosis of brain tumor.

In the case reported by Tyrell¹⁷³ the polycythemia was complicated with hyperthyroidism.

TREATMENT. Marsh¹⁷⁴ reviews the different methods of treatment which have been tried, such as splenectomy, venesection, application of various rays over the spleen and long bones, and the administration of drugs. The value of *splenectomy* is problematic, although it might be considered worthy of trial when other measures have failed, especially in cases with repeated severe hemorrhages from the stomach. The majority of writers consider splenectomy as contra-indicated and the removal of the spleen has been rapidly fatal in a number of instances. *Venesection* gives definite symptomatic relief and is the procedure to be advocated, although even if repeated frequently fails to produce permanent results. The x-ray has been used with marked benefit in some cases, but only with temporary effect as a rule. In some cases it has not produced any appreciable change in the number of red cells or upon the spleen. *Radium* has been used less frequently and is similar in its action to the x-ray, that is, the benefit produced is only temporary. Of the various *drugs*, *benzol* as reported several years ago by McLester seems to be strikingly efficient in some cases. Marsh recalls the report of McLester's case in which prior to the administration of benzol there was a red cell count of 7,120,000, a white cell count of 28,000, hemoglobin 85 per cent. Following a five months' administration of benzol with a maximum daily dose of 4 gm. the red cells numbered 6,600,000, the leukocytes 10,000. Within the next weeks the red cells dropped to 5,000,000. The patient had been well only seven weeks when the case was reported. McLester did not consider the patient cured, and believed that another increase would occur requiring further administration of benzol. Marsh states that the nitrites, bromides, arsenic and mercury have been tried and have all been discarded.

Pernicious Anemia. ETIOLOGY. CHEMISTRY. A study of the functional capacity of the various organisms in three cases of pernicious anemia are carried out by Kahn and Barsky.¹⁷⁵ Their principal finding was a deficiency in the hepatic detoxication function which they believe may be a causative factor of the disease. The failure of the liver to neutralize the poisons generated in the gastro-intestinal tract results in the absorption of these poisons by the blood with the resulting blood destruction. Their other findings are as follows:

The blood analysis showed a lessened specific gravity of the serum, reduction of the protein content, and increase in the ash and lime content, and a normal fat, cholesterol and glucose percentage. There was complete anacidity present in the stomach, an increased residuum, and absence of pepsin, resembling the gastric picture present in cases of

¹⁷³ British Medical Journal, 1919, ii, 506.

¹⁷⁵ Archives of Internal Medicine, 1919, xxiii, 334.

¹⁷⁴ Ibid.

carcinoma ventriculi. The Wolff-Junghans test was negative. Intestinal digestion was disturbed. The fecal bulk was much increased, and the nitrogen lost in the feces was above normal in amount. The fat in the feces was normal. Intestinal putrefaction, as evidenced by increased ethereal sulphate output, was present. There was a state of suboxidation—the neutral sulphur fraction was increased. The pancreas functionated normally, as evidenced by enzyme examination of duodenal contents and feces. There was a deficiency in the hepatic detoxication function as shown by the sulphoconjugation test. The glycogenic and ureogenic functions of the liver were normal. The excessive hemolysis of pernicious anemia was attended by both a pleochromia and urobilinocholia. In this regard Schneider's experiments are corroborated. There was an increased elimination of xyproteic acid nitrogen in the urine in cases of pernicious anemia; the other urinary nitrogen fractions being normal. The renal function was normal, as evidenced by the phenol-sulphonaphthalein test and the blood nitrogen partition. The creatinin in the blood was increased. Acidosis was present in the cases examined, as determined by the carbon dioxide combining power of the blood plasma, the H ion concentration of the blood, and the carbon dioxide of the alveolar air.

Hansmann and Howard¹⁷⁶ investigated the value in diagnosis and treatment of urobilin and urobilinogen of stool and urine in pernicious anemia. They investigated 27 cases of pernicious anemia and as controls 9 miscellaneous conditions which included 1 case each of chlorosis, carcinoma ventriculi, purpura, familial hemolytic icterus, Banti's disease, lymphosarcoma, acute cholecystitis, hemochromatosis, and tabes dorsalis. The method used was a modification of Wilbur and Addis' spectroscopic method which the authors describe. They found that an increase of the urobilin and urobilinogen in the urine and stools above 12,000 dilutions is a constant finding in pernicious anemia during the period of remission.

The presence of even small amounts of urobilinogen in the urine is evidence of a probable pernicious anemia in the absence of signs of biliary or hepatic disease.

A low red cell count with a low urobilin and urobilinogen count indicates an arrest of the activity of the disease process, and a period of improvement may be anticipated.

On the other hand, a high red cell count with a high urobilin-urobilinogen content indicates a marked hemolysis and often precedes a steadily falling blood count, as was also demonstrated by Robertson and McCrudden.

CLINICAL MANIFESTATIONS. The gastro-intestinal disturbances in pernicious anemia have been studied over many years, notably since 1860, when Austin Flint called attention to the possible dependence of certain cases of pernicious anemia on certain degenerative changes in the gastric mucosa. Friedenwald and Morrison¹⁷⁷ have recently reviewed some of the past observations on this relationship. They report a per-

¹⁷⁶ Journal of the American Medical Association, 1919, lxxiii, 1262.

¹⁷⁷ Ibid., 407.

sonal experience of 76 cases of pernicious anemia in which gastro-intestinal symptoms were noted (58 of these were reported previously in 1912). Of the 76 cases there were 64 males and 12 females, the ages ranging between thirty and sixty-five years. The symptoms manifested were loss of appetite, nausea, vomiting, indigestion (fulness, pressure, distention, pain), diarrhea and constipation.

Loss of appetite was observed in 47 cases, nausea in 37, vomiting in 26, indigestion in 46, diarrhea in 28, constipation in 35, and irregularity of the bowels in 13. The liver was enlarged in 24 instances, while in 52 it was not. Enteroptosis was present in 28 instances and atony of the stomach in 34. Gastric catarrh was present in 11 cases. The gastric contents were examined in 57 of the 76 cases. In 42 of these there was an absence of gastric secretion (achylia gastrica). In 11 the gastric secretion was diminished and in 4 it was normal. In the 42 cases with an absence of gastric secretion, the total acidity ranged between five and sixteen. In the 11 with diminished gastric secretion, the total acidity ranged between eighteen and forty-one, free hydrochloric acid between five and twelve. In the 4 with normal digestion the total acidity ranged between forty-four and sixty-five, free hydrochloric acid between thirty-two and forty-four. The gastric secretion was examined in 11 patients presenting an absence of free hydrochloric acid during the period of improvement in the state of the blood as well as of the general health; in none did the secretion return during the stage of apparent recovery.

Friedenwald and Morrison also examined 6 cases of pernicious anemia according to the Rehfuß method of fractional analysis. There was in all a low total acidity ranging between ten and fifteen with an entire absence of free hydrochloric acid in every stage of the digestion. The Wolff-Junghans test always presented low protein values, thus differentiating this condition from gastric cancer.

From a study of the 76 cases of pernicious anemia, it is evident that a large proportion of these cases are attended with gastro-intestinal disturbances as well as with an absence of gastric secretion; there is present an achylia gastrica in about 74 per cent. of the cases, and even in the stage of apparent recovery the gastric secretion does not return. In a smaller proportion of cases, 19 per cent., there is a marked diminution of the secretion, and in a few instances, about 7 per cent., it remains normal.

Another group of symptoms in pernicious anemia which are second in importance only to those of the gastro-intestinal tract are those referable to the *nervous system*. Woltmann¹⁷⁸ found among 150 patients examined that 80.6 per cent. presented indisputable evidence of the destruction of nervous parenchyma. Approximately 12.7 per cent. of the patients came for the express purpose of seeking relief from symptoms directly attributable to involvement of the nervous system. Chief among these were the paresthesias, especially numbness and tingling of the hands and feet, which were present in about 80 per cent. of all cases, regardless of whether or not involvement of the nervous system could

¹⁷⁸ American Journal of Medical Sciences, 1919, clii, 400.

be demonstrated objectively. Occasionally a patient complains of a girdle pain (2.8 per cent.), or the sensation of a tight band drawn around the knees (1.7 per cent.). A number presented themselves for examination because of inability to control the arms and legs properly. In the motor field, cramping of the calves occasionally proved to be the source of great discomfort.

In relation to the *cranial nerves*, diminution in the sense of smell, taste and hearing was noted. In 1.4 per cent. of the cases the appearance of nervous symptoms antedated the onset of the anemia, the symptoms that preceded being usually the paresthesias. The duration of the anemia also showed no definite relationship to the time of onset in the nervous symptoms, though in the cases examined the mean duration of the anemia was 2.2 years and the mean onset of the nervous symptoms ten and a half months later. The type of lesion par excellence of the nervous system, as evidenced clinically, is a subacute combined degeneration of the cord, regardless of whether this begins in the posterior or the lateral columns or in both simultaneously, though the columns of Goll and Burdach are in the majority of cases first and most extensively involved. Multiple neuritis could be demonstrated in addition to the spinal cord lesion in 4.9 per cent. of the cases.

It is interesting to note, according to Cabot and Richardson,¹⁷⁹ that cardiac hypertrophy is often associated with pernicious anemia. These writers tabulate the results of necropsies in 19 cases of pernicious anemia in which 18 showed a definite hypertrophy or dilatation of the heart. In 3 of these (Cases 5, 10 and 12), possible causes for the hypertrophy were found in the arteries, the kidneys or valvular lesions of the heart itself. In the other 15 cases (or 83 per cent.), none of the usual causes (or accompaniments) of cardiac hypertrophy were present.

A long duration of *remission in pernicious anemia* is reported by Stockton¹⁸⁰ whose patient was first seen in 1899. In the six years following an irregular improvement was noted. In 1907, the blood picture was normal and although no blood examination was made from 1907 until 1918 she was considered to be well except for one sign—the persistence of achylia gastrica. In 1918, there was a sudden recurrence of the anemia which failed to respond to arsenic which formerly had been of benefit. A transfusion was only of transient benefit. Pneumonia developed and the patient died. The persistence of the achylia gastrica is interesting and Stockton asks if in the prevailing belief that an exceptional case of pernicious anemia goes on to recovery has anyone ever noted the restoration to normal of the gastric function. He doubts if anyone ever entirely recovers from pernicious anemia.

TREATMENT. Hamman¹⁸¹ states that pernicious anemia is inevitably fatal and treatment at best can but promote and prolong the remissions that characterize the natural course of the disease. According to Hemman, there is no conclusive evidence to prove that one method of treat-

¹⁷⁹ Journal of the American Medical Association, 1919, lxxii, 991.

¹⁸⁰ American Journal of Medical Sciences, 1919, clviii, 471.

¹⁸¹ Medical Record, May 31, 1919, 933; Abstract, Journal of the American Medical Association, 1919, lxxii, 1567.

ment brings on remission more constantly than another, nor that it more surely prolongs remissions thus begun. Spontaneous remission may be in every way as satisfactory as remission following the use of any method of treatment. In pernicious anemia, as well as in all other conditions for which we have only symptomatic or palliative treatment, success depends more on a judicious selection from among all available methods of treatment and their proper combination than on a one-sided advocacy of a single method. Rest, feeding, arsenic, transfusion, the eradication of foci of infection and perhaps also splenectomy have a definite place in the treatment of pernicious anemia.

Anders,¹⁸² who made a collective investigation on the value of transfusion of blood in pernicious anemia, states that it offers more for this incurable disease as a means of prolonging life than any other form of treatment including splenectomy, which, moreover, causes immediate death in a not inconsiderable percentage of cases. Following two injections of 500 c.c. of whole blood (ten months apart), Anders's patient was so much improved in every way that he was able to attend to duties that he had not performed for the past ten years. Anders reviews the literature of 362 cases in which the result was given; in 204, or 56.3 per cent., there was an initiation of remissions. The average number of transfusions per patient was 2.4.

Garbat¹⁸³ lauds the value of transfusion by the sodium citrate method and reports the results of 33 transfusions performed on 15 patients. Five patients showed little or no effect; of these, three were practically moribund at the time of transfusion and died within a few hours or days. The other 2 showed improvement for several days, and then, in spite of the temporary increase in hemoglobin and red blood cells, the anemic symptoms rapidly reappeared and the patients died. Of the other 10 patients all showed a progressive improvement following one or more transfusions. While it is known that patients with pernicious anemia have remissions even without transfusion, it seemed that remissions were initiated more promptly with the aid of transfusions. These remissions lasted from four weeks to twelve months, and in one case two years. All the cases of this series were of a severe type of pernicious anemia and came under treatment late during the course of the disease. It is certain that had not transfusions been done, death would have occurred within a short period of time. The immediate effect of the transfusion on the symptoms associated with the anemia is marked. A very annoying symptom often complained of most bitterly by patients is the peculiar "surging" noises in the head, keeping the patient from resting and possibly due to the diminished viscosity of the blood. With one of these patients this was the first sign that the anemia was increasing and this was always corroborated by a much lowered hemoglobin. This manifested itself on four different occasions, and with each of the four transfusions which followed, after about 600 c.c. of blood had run into the veins, these noises regularly disappeared.

Improvement in the other symptoms becomes evident after several

¹⁸² American Journal of Medical Sciences, 1919, clviii, 659.

¹⁸³ Journal of the American Medical Association, 1919, lxxii, 1.

days; in some cases sooner. The hemoglobin and red blood cells always increase; the general strength of the patients improves; so much so, that they are able to get out of bed and walk without becoming faint or breathless; the frequent disgust for foods lets off; they even get an appetite, and the digestive disturbances disappear. The rapid pulse becomes slower; and in two instances in which loud systolic murmurs were present over the entire precordium prior to transfusion, the murmurs almost entirely disappeared after the transfusion, only to reappear again, however, when the severe anemia returned. In three instances in which the patients had mild temperatures for weeks previous to the transfusion, these subsided within forty-eight hours after the transfusion. This should not be taken as characteristic of pernicious anemia, as the same observation was made in transfusion for simple chronic secondary anemia after hemorrhage (anemic fever).

When the patient has approached the critical period in pernicious anemia, certainly, as Lindeman¹⁸⁴ points out, there is no other therapeutic measure that has the power and efficacy of blood transfusion of unmodified blood in large amounts in robbing the disease of its terrors. Remissions may be provoked. When remissions cannot be provoked promptly, the patient bears the disease better and will be the better able to await the favorable moment for improvement with a prolongation of life.

Although *splenectomy* for pernicious anemia has been a disappointment and the operation has been largely abandoned, it is of interest to know the results of the experience of the Mayo Clinic as described by Szlapka.¹⁸⁵ A total of 50 patients whose condition was definitely diagnosed as pernicious anemia were operated on in the Mayo Clinic between January 1, 1910, and April 1, 1917; 42 of these patients are now dead; 3 deaths were operative. All of the 8 surviving patients have been splenectomized about three years and six months. Szlapka states that after scrutiny of the course of these 50 patients they are unable at the Mayo Clinic to advance any chain of reasoning to explain their different reactions to splenectomy. Sex, age, previous infections, the duration and severity of the disease, degree of anemia, hemolytic activity, diarrhea and other gastro-intestinal disturbances, involvement of the central nervous system, the size of the liver and spleen, and so forth, are being traced in the hope of identifying cases favorable for operation, and especially of obtaining additional light on the etiology of the disease. Thus far, their efforts have not led to any definite conclusions.

APLASTIC ANEMIA. This type of pernicious anemia, as is generally known, is characterized by a rapidly fatal course and associated with a failure of bone marrow regeneration. One does not find nucleated red cells in the circulation. At autopsy, the red marrow is found to be aplastic, with an increase of fat and a diminution of megaloblasts and normoblasts. The course of the blood changes in such a patient has been reported by O'Malley and Conrad.¹⁸⁶ Four months before the patient's

¹⁸⁴ Journal of the American Medical Association, 1919, lxxiii, 896.

¹⁸⁵ Medical Clinics of North America, 1919, iii, 773.

¹⁸⁶ Journal of the American Medical Association, 1919, lxxiii, 1761.

admission nothing in his general condition suggested anemia, but the leukocyte count was on the lower level of normal, 6750. From the patient's history, the duration of the disease was probably between five and six weeks. Certain it is that the disease was not evident clinically for more than three weeks. Fig. 77 shows the effect on the red cells of two transfusions. In spite of the transfusions the patient died, and partial necropsy was allowed. This showed that the liver was enlarged and hard, and sections showed cloudy swelling with a slight increase of connective tissue. There was considerable bile pigment, but special staining failed to demonstrate hemosiderin. The rib, when cut across, showed a small area of light red marrow.

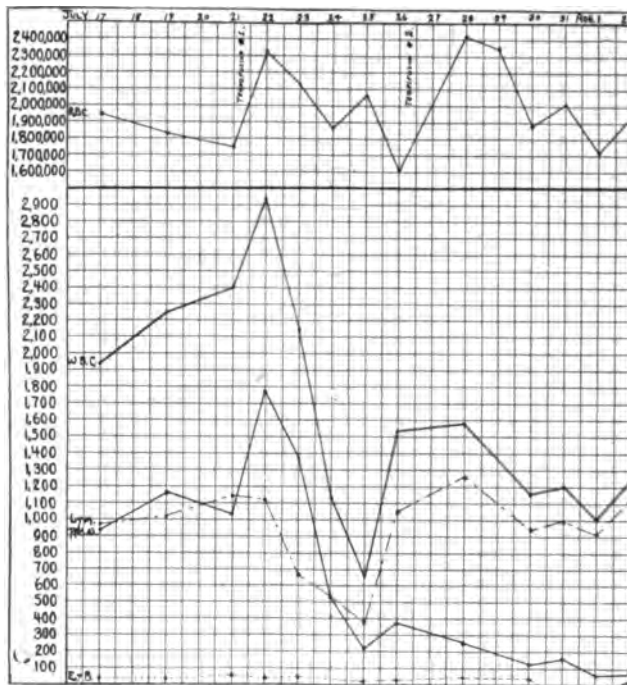


FIG. 77

Smears from this showed few cells, mainly small mononuclears and red cells. Sections showed large vacuoles, formerly occupied by fat, with narrow strands of marrow tissue between. The marrow tissue was composed mainly of small mononuclears (lymphocytes) with a few non-nucleated red cells and an occasional myelocyte. Compared with the marrow of a normal rib, there did not appear to be an increase of lymphocytes, but rather a marked diminution of myelocytes and nucleated red forms with a tremendous increase of fat, while the lymphocytes were unaffected and remained in normal numbers.

Another interesting case of aplastic anemia is reported by Smith.¹⁸⁷

¹⁸⁷ American Journal of Diseases of Children, 1919, xvii, 174.

The patient was a boy who, except for measles eight months previously, had been apparently well until two weeks prior to admission to the hospital. He gave the appearance of a rather severe secondary anemia. There was fever, slight swelling of the face and a few purpuric manifestations. The blood-picture showed hemoglobin, 40 per cent.; red count, 1,500,000. The differential white count showed a beginning relative lymphocytosis and a drop in the leukocytic proportion; a good deal of poikilocytosis, anisocytosis and polychromatophilia. Three months after the boy was first seen, the red cells numbered 700,000, hemoglobin, 18 per cent.; an obvious relative lymphocytosis. The immediate cause of death was a failing circulation with dilatation of the heart, accompanied by decompensation. The edema of the lungs was partially responsible as well. At the necropsy there was found an extreme marrow aplasia. The Malpighian corpuscles in the spleen gave very definite evidence of prolonged toxic action such as is seen especially in diphtheria, or in any of the prolonged febrile diseases. It is frequently concomitant with measles. Smith is convinced that this is, perhaps, the most obvious answer to the whole story—the prolonged toxic action of the toxin of measles, acting in a cumulative sort of fashion, until the marrow became exhausted.

Parkinson¹⁸⁸ reports the case of a boy, aged nine years, who for a month had been bleeding at the mouth with painful swollen lips and sore gums. For a fortnight he had complained of headache and was noticed to be pale and easily short of breath. There were numerous bruises over the body and a rash resembling flea bites.

The red cells numbered only 1,260,000; hemoglobin, 20 per cent. The cause of the profound anemia was obscure. There was no reason to suspect scurvy, hemophilia, tuberculosis, lead poisoning or syphilis. The Wassermann reaction was negative. The blood showed marked leukopenia, due almost entirely to diminution in the number of the polymorphonuclears, the lymphocytes being in relative excess, but actually about normal in number. The anemia subsequently increased and the hemorrhages in the gums continued. The red cells went down to 624,000; the hemoglobin was 17 per cent. Then 300 c.c. of blood mixed with 30 c.c. of citrate solution were injected intravenously. The patient's color improved greatly during and after that procedure. A second transfusion was carried out ten days later. The child grew weaker and weaker and more drowsy, and had incontinence of urine and feces. Another transfusion was refused. The boy lay unconscious for a fortnight and then slowly improved. At the present time he seems to have recovered completely.

The more important symptoms supposed to be typical of aplastic anemia have been contrasted with pernicious anemia in a tabulation by Archibald.¹⁸⁹

¹⁸⁸ *British Journal of Children's Diseases*, London, 1919, xvi, 1.

¹⁸⁹ *Medical Clinics of North America*, 1919, iii, 757.

CLINICAL FINDINGS.

APLASTIC ANEMIA.

Onset—usually early in life.
 The cause—usually unknown.
 Onset and progress acute and rapid.
 No remissions.
 Hemorrhages and petechiæ—common.

Fever—usually.
 Weakness, dyspnea, etc.
 Mouth not sore.
 No numbness.

PERNICIOUS ANEMIA.

Onset in adult life.
 Cause—unknown.
 Onset and progress slow and chronic
 Remissions.
 Hemorrhages and petechiæ somewhat rare.
 Fever—none or slight.
 Weakness, dyspnea, etc.
 Mouth sore.
 Numbness.

BLOOD PICTURE.

Low color index.
 Leukopenia.
 Relative increase in small lymphocytes.
 No evidence of regeneration, for example, in the presence of normoblasts and megaloblasts.
 No evidence of hemolysis, for example, the presence of a yellow tint and urobilinogen in the urine and in the duodenal contents.

High color index.
 Leukopenia, especially in advanced cases
 Relative increase in small lymphocytes.
 Evidence of regeneration.

Evidence of hemolysis.

PATHOLOGICAL FINDINGS.

Aplastic bone-marrow.
 Usually no evidence of hemolysis.

Hyperplastic bone-marrow.
 Evidence of hemolysis.

It should not be forgotten, however, as Archibald points out, that there is no definite proof on which to form an opinion whether aplastic anemia is, or is not, allied to pernicious anemia, and it should be remembered that cases do occur which have the characteristics of both diseases, not only clinically but pathologically.

PERNICIOUS ANEMIA AND TROPICAL SPRUE. The not infrequent occurrence of sprue outside of the tropics is pointed out by Wood,¹⁹⁰ who states that in North Carolina, for example, its occurrence is no longer a medical curiosity. In discussing the blood-picture, he states that he believes that many cases of sprue have been called pernicious anemia, and on the other hand, some cases of pernicious anemia have been diagnosed as sprue. A brief reference, therefore, to Wood's description of the symptoms of the disease is important. He states that there are three groups: Those of the mouth, intestinal tract and the blood. The tongue is inflamed and pink, with congested fungiform papillæ, eroded patches and superficial cracks on the dorsum and edges. Crombie's molar ulcer is frequently mentioned as a helpful symptom, but Wood has observed it even more frequently in pellagra. The tongue in sprue is quite different from the tongue in pellagra. In the latter disease it will be found more pointed and not so flabby. In sprue, it is very much paler than in pellagra. There is also, in sprue, an approach to the cobblestone appearance which does not occur in pellagra. After a short experience with the two diseases, any observer may expect to make a correct differentiation by examining the tongue alone.

¹⁹⁰ Journal of the American Medical Association, 1919, lxxiii, 165.

The diarrhea in sprue is the most distinctive symptom. The bowel movements occur from midnight until about 10 o'clock in the morning. There then occurs a cessation until the next day. If the cessation does not occur, there will be, at least, a marked diminution in the number of movements in the afternoon and early hours of the night. The bowel movements are very large, suggesting at once a pancreatic condition. The reaction is decidedly acid, and there is much gas mixed with the feces. Examination of the feces reveals a large amount of fat. The stools are light in color and give a positive reaction for hydrobilirubin. Pratt and Spooner, with the Schmidt-Strassburger test-diet, found a fat loss of 45 per cent., and a nitrogen loss of 15 per cent. P. H. Bahr, in his Ceylon cases, found a fat absorption of from 70 to 90 per cent., which is much greater than was shown in Wood's experience. In addition to this failure in the utilization of fat and nitrogen, there are other evidences of pancreatic insufficiency indicated by the thymus nucleus test and the Sahli glutoid salol capsule test.

The blood-picture in a large number of cases shows the color index above 1, and a case now under Wood's observation gives a persistent index of 1.66. The anemia has always been regarded as secondary, and Wood has no wish to question this point; but it is important to show how the condition may be confused with pernicious anemia. He believes that many cases of sprue have been called pernicious anemia. On the other hand, some cases of pernicious anemia have been diagnosed as sprue. One such experience has befallen me.

In sprue, Wood has noted the most marked variation in the size of the red cells. There was found in a recently studied case a decided preponderance of over-sized cells, as well as numerous dwarf cells. There also occurs poikilocytosis. It was noted that there were many very pale cells in the field when the blood was stained with any of the eosinates of methylene blue. Stipple cells were very rarely found. In the case referred to above, in which the blood was carefully studied on different occasions in many slides, no nucleated red cells were found. The notes of Wood's patient are of considerable importance and I am quoting as follows:

CASE.—Mrs. H., aged thirty-seven years, the mother of three children, was married to a sawmill worker, moving from point to point in North Carolina, and living under rather unfavorable hygienic conditions.

The present trouble is said to have begun at the birth of the third child in September, 1918. She denied ever having had any form of anemia before. Her physician's information was limited because of the fact of her moving about at short intervals from one saw mill to another. Following the birth of the third child, she had a rather severe influenza and has never been well since. Owing to a sore mouth and tongue, in addition to extensive pyorrhea, she was advised to have all her teeth removed, which she did. Throughout the winter the diarrhea, which was of the matutinal character, and the anemia persisted. There seemed to have been only the very slightest variation in the severity of either symptom. The physical examination was practically negative. The liver dulness was slightly reduced. The spleen was not palpable. The patient had lost some flesh.

The red blood count was 600,000; the hemoglobin, 20 per cent.; the color index 1.66. No megaloblasts nor normoblasts were found on repeated examination of many slides. There were no stipple cells. There was a marked difference in the way in which the red cells took the stain. This was shown chiefly in numerous strikingly pale cells. There was a preponderance of oversized red cells, the percentage ranging from 25 to 30. The fragility test of the red cells with hypotonic salt solutions showed that hemolysis had begun at the 0.45 per cent. point and was complete at the 0.3 per cent. point. This we regarded as normal.

The white blood count was 3200; polymorphonuclears, 40 per cent.; large lymphocytes, 16 per cent.; small lymphocytes, 44 per cent. No parasites of malaria were found. The blood Wassermann test was negative. There was an absence of free hydrochloric acid in the stomach contents, and marked stasis.

The feces were light yellow, and were very acid in reaction. Crystals and droplets of fat were found on microscopic examination, after staining with sudan III. The beef nucleus test showed that while the nuclei of the muscle fibers were in great measure digested, there persisted nuclei which had not been completely digested. The agar tubes of Einhorn failed to give returns from which any conclusions could be drawn, probably because of faulty technic. The three-day test-diet was given and the examination to determine the absorption of fat and nitrogen undertaken; but they cannot be reported on now.

There was no tenesmus or blood with the diarrhea. The movements were for the most part large.

Leukemia.—Instances of acute leukemia have been reported by Lindbom,¹⁹¹ Mármol,¹⁹² Sicard¹⁹³ and Peutz.¹⁹⁴ Lindbom believes that there is much to sustain the view that leukemia is an infectious disease, although attempts to cultivate the germ and transmit the disease have failed to date. Mármol's patient was a woman who developed headache, fever, lassitude and sore-throat from which pyogenic cocci were cultivated. The diagnosis of lymphatic leukemia was made and the blood examination revealed a mononucleosis of 91.3 per cent. The patient improved, became afebrile by the twelfth day, the liver and spleen returned to normal size and convalescence seemed assured. On the thirty-third day, however, the symptoms returned and grew worse, with death nine days later.

Sicard's patient, a clerk, aged forty-six years, in previous good health, developed symptoms of impaired vision, insomnia and digestive disturbance. Spirochetes were found in the urine during life. Death occurred in five months. Autopsy revealed fatty degeneration of the liver, and spirochetes were found in this organ and in the kidney.

¹⁹¹ Svenska Läkaresällskapets Handlingar, Stockholm, 1919, xlv, 83; Abstract, Journal of the American Medical Association, 1919, lxxiii, 730.

¹⁹² Vida Nueva, Havana, 1919, xi, 123; Abstract, Journal of the American Medical Association, 1919, lxxiii, 1319.

¹⁹³ Bulletins de la Société Médicale des Hôpitaux, Paris, 1918, xlii, 934; Abstract, Journal of the American Medical Association, 1919, lxxii, 149.

¹⁹⁴ Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, 1919, i, 655; Abstract, Journal of the American Medical Association, 1919, lxxii, 1503.

Peutz's patient was a lad, aged four years, who, previously healthy, became ill, with hemorrhages into the skin and from the kidney. This was followed by enlargement of the spleen and superficial lymphatic glands. The white cell count was 720,000. The blood culture was sterile. Upon investigation, Peutz found that the patient had had a fall two weeks before the first symptoms, and the shock from this, superimposed on the status lymphaticus, may have brought on the disease.

Martelli,¹⁹⁶ who has made a special study of blood diseases, found, in 45 cases of leukemia, that tuberculosis existed in 13, syphilis in 7, malaria in 5, streptococcus or staphylococcus sepsis in 4 and various other bacteria in 10. He maintains that by vigorously combating these primary diseases, the tendency to leukemia may be arrested. He refers to these conditions as preleukemic states and they exist, particularly in children.

Leukemia with marked anemia is illustrated in the two cases reported by Gram.¹⁹⁶ In one, a man, aged sixty-six years, the lymphatic leukemia, splenomegaly and anemia of pernicious type was unassociated with enlargement of the lymphatic glands. In the other, a young woman, the same clinical picture existed associated with lymphatic glandular enlargement.

TREATMENT. Haughwout and Asuzano¹⁹⁷ report beneficial results from the use of benzyl benzoate in a case of lymphatic leukemia of several years' standing. The initial dose was 10 drops of a 20 per cent. alcoholic solution three times a day after meals. Later the dose was reduced to 5 drops and then increased to 10 drops. The authors make no special claim for the drug except that it was free from evil tendencies and apparently caused improvement in all the symptoms.

The value of *blood transfusion* is questionable. It is not used with any idea of effecting a cure, but rather in the hope that the condition may be influenced to take a more chronic form with a resultant prolongation of life or for the purpose of counteracting any acute complication or symptom associated with the disease. Garbat¹⁹⁸ reports the result of blood transfusion by the citrate method in four cases of lymphatic leukemia and one case of myeloid leukemia, and in all temporary benefit occurred. A review of two of his brief case records are of interest in this connection.

One patient with *acute lymphatic leukemia* had severe bleeding from the nose and gums so that the loss of blood was becoming alarming. In addition, the patient had a high temperature. After the first transfusion of 600 c.c. of blood, the bleeding ceased, the fever came down, the hemoglobin rose from 28 to 60 per cent., and the patient felt much improved. This happy state of affairs lasted only for several weeks, when a renewed transfusion did not bring about a similar successful response. The high fever returned and the patient died.

¹⁹⁶ *Pediatrics*, Naples, 1919, xxvii, 385; Abstract, *Journal of the American Medical Association*, 1919, lxxiii, 799.

¹⁹⁶ *Hospitalstidende*, Copenhagen, 1919, lxii, 77; Abstract, *Journal of the American Medical Association*, 1919, lxxii, 1262.

¹⁹⁷ *New York Medical Journal*, 1919, cx, 180.

¹⁹⁸ *Journal of the American Medical Association*, 1919, lxxii, 1.

A child, aged three and one-half years, with *chronic lymphatic leukemia*, showed marked improvement after a transfusion of 300 c.c. of blood. The change in the blood picture was very striking. The hemoglobin rose from 10 to 34 per cent.; the red cells increased from 1 to 2 million; the white blood cells decreased by 5000 or more every day, so that three days after transfusion the leukocytes had diminished from 33,800 to 13,200; and whereas before the transfusion there were 100 per cent. lymphocytes, three days after the transfusion there were 28 per cent. polymorphonuclears. The general condition improved in the same striking way and kept up one week. Then another transfusion was given, but this time twice the quantity (600 c.c.). This may have been too much, as two days afterward there was dilatation of the heart and a slight edema of the lungs which ended fatally in five days. The blood picture, however, was remarkable; hemoglobin, 75 per cent.; red blood cells, 3,200,000; white blood cells, 7200, and polymorphonuclears, 23 per cent.

Hodgkin's Disease. A typical case of Hodgkin's disease with its enlargement of the external lymph nodes is readily recognized. The atypical forms, however, without involvement of the superficial nodes may present at times considerable difficulty. Wessler and Greene¹⁹⁹ have studied 25 cases of Hodgkin's disease in order to determine the frequency of intrathoracic involvement and especially to ascertain whether the roentgenogram offers anything characteristic which may be of help in the diagnosis of doubtful and atypical cases. Among the 25 cases distinct evidence of involvement of the intrathoracic nodes was found in every case. They classify the changes noted on the x-ray plates under four types, the significance and frequency of which are described as follows:

1. *Mediastinal Tumor.* Thoracic Hodgkin's disease may appear on the roentgen plate typically as a mediastinal tumor. Large massive shadows are seen extending outward from the mediastinum into the lungs; they have smooth or lobulated borders and show little or no evidence of the individual component lymph nodes. Such shadows were present in eight of the cases. By themselves they offer nothing characteristic of Hodgkin's disease and cannot be distinguished from other mediastinal growths, such as lymphosarcoma.

2. *The Infiltrative Type.* In this form of Hodgkin's disease the lymphomatous tissue appears to invade the neighboring lung very much as a malignant neoplasm. It is doubtful whether this is a true invasion of the lung; it is not improbable that in this form of the disease there is a diffuse transformation of the intrapulmonary lymphoid tissue into granuloma. However, on the roentgen plate the borders of the apparently infiltrating mass are indistinct and irregular and appear to grow into the lung. This is an infrequent form of the disease, and it occurred in only four cases.

3. *Isolated Nodules or Metastases in the Lung.* In a small number of cases there are seen in the pulmonary fields, and having no connection with the mediastinum, circular or oval shadows of moderate density.

¹⁹⁹ Journal of the American Medical Association, 1920, lxxiv, 445.

They are usually small, from one to several centimeters in diameter. By themselves they are not to be distinguished from metastatic new growths in the lungs.

The invariable presence, however, of lymphomatous masses at the roots of the lungs, next to be described, usually renders possible their recognition as a form of Hodgkin's disease. This type was found in four cases, always in association with one of the other forms of the disease. In accordance with the commonly accepted belief, these shadows do not represent true metastases, but are rather autochthonous foci developing in preëxisting pulmonary lymphoid tissue.

4. *Discrete Nodes at the Roots of the Lungs.* The most common form of Hodgkin's disease of the chest is the analogue of the external glandular enlargement and consists, like it, of masses of more or less discrete nodes at the roots of the lungs. It was present in seventeen cases. On the roentgenogram it provides, in typical cases, some points of distinction from other forms of adenopathy.

The shadows extend often for a considerable distance from the roots of the lungs, and individual nodes or groups of nodes retain their outline. It is characteristic of the shadows that they are faint; and in this respect they differ from those of new growth and tuberculosis. They are particularly distinguishable from the latter by an absence of caseation and calcification. Tuberculous nodes, when they have achieved the size of those found at the hilum in Hodgkin's disease, are invariably cheesy, and the shadows are irregular and of great density. For this reason, large lobulated shadows at the roots of the lungs which are faint and homogeneous raise a strong presumption of Hodgkin's disease, a presumption which will be strengthened if there are found outlying deposits in the lungs, such as were described under Type III. The various groups of nodes may be involved, the bronchial bifurcation or bronchopulmonary. Of greatest interest, however, is an involvement of the right paratracheal nodes which occurs so frequently in Hodgkin's disease as to acquire a major importance in the diagnosis. It occurred in no less than fourteen cases, either alone as a solitary manifestation of intrathoracic disease or, as was usually the case, in association with the other forms of the disease previously described.

Wessler and Greene conclude from their studies as follows:

1. A large percentage of the cases of Hodgkin's disease have demonstrable intrathoracic lymphomas.
2. Although the roentgenogram in some cases presents nothing characteristic, in a considerable number a distinction from other forms of new growths or glandular enlargement can be made.
3. There is a frequent and unique enlargement of the right paratracheal group of nodes which occurs only rarely in other diseases.
4. In doubtful or atypical cases of Hodgkin's disease, the x-ray examination of the chest may help to establish the diagnosis.
5. X-ray examination of the chest should be performed in all cases, before they are pronounced cured after treatment.

Lyon²⁰⁰ has reported the case of mediastinal Hodgkin's disease in a

²⁰⁰ American Journal of Medical Sciences, 1919, clviii, 557.

young adult male. The lesion had existed for sixteen months and had caused pressure erosion of the chest wall. The patient died of toxemia and exhaustion. At autopsy the chief pathological findings were extension of the mediastinal neoplastic growth into the right lung, involvement of the bronchial and mediastinal lymph nodes, of many abdominal lymph nodes and of the retroperitoneal and inguinal nodes. Metastatic-like growths were found in the unenlarged spleen, in the tail of the pancreas, in the right kidney and in the epicardium and beginning to invade the myocardium. The liver and the cervical, maxillary and axillary lymph nodes were uninvolved.

A case of Hodgkin's disease in a girl, aged two years, is reported by Porter.²⁰¹ In commenting Porter states that the case presented the following unusual features: (1) The early age of onset; (2) the female sex of the child (males are affected at a ratio of 6:1); (3) rapid onset which followed what was undoubtedly an infection involving the gastrointestinal tract; (4) early and extreme involvement of the mesenteric and retroperitoneal glands; (5) late and slight involvement of the cervical glands which are usually affected early and profoundly; (6) remarkable, extensive and early involvement of the skin in morbid process; (7) extreme edema of the legs while the anemia was still far from profound; (8) intermittence of the fever and the toxic symptoms which on several occasions gave an unwarranted hope for improvement; (9) repeated but temporary improvement of the child after blood transfusions; (10) absence of any demonstrable infective agent, *Cornebacterium hodgkini* or other organisms in the glands for diagnostic purposes; (11) extensive invasion of the lung septums by the endothelial cells characteristic of this disease (ordinarily such invasion is limited to the peribronchial and superficial pleural areas of the lung); (12) unusual size of the spleen, which in this disease most often is but moderately enlarged. It extended as far forward as the umbilicus and down to within an inch or less of the iliac crest.

The Leukocyte Count Among Soldiers with Irritable Heart in Trench Fever and in the Acute and Chronic Infections. The morphology of the blood with reference to the white cells was investigated by Gay²⁰² in soldiers with irritable hearts in the hope that something of significance might be found to assist in diagnosis. A large series of selected cases in which no organic lesion of the heart and no foci of infection were present, were carefully studied. Gay's conclusions are as follows:

1. There is a slight leukocytosis in the unclassified group of patients with "irritable heart." The figures in this correspond, however, to those found in the patients with organic heart disease.

2. The type of patient classed as "Constitutional Inferior" has a high leukocytic count. The other types studied have a normal count.

3. There is a relative lymphocytosis present in the blood of patients with "irritable heart," the limits being between 15 and 51 per cent. An eosinophilia is likewise present, but too much importance cannot be given to this finding, since the presence of parasites was not ruled out.

²⁰¹ Virginia Medical Monthly, 1919, xlv, 109.

²⁰² Archives of Internal Medicine, 1919, xxiii, 603.

4. A marked leukocytosis occurs in both patients and controls after the injection of epinephrin. This increase is much greater in the patients with positive reaction than in the controls, who did not respond to the drug.

5. There is no greater variation in the differential formulas after the injection of adrenalin than was to be found before. The eosinophilia persisted in about the same proportion as before.

6. The morphologic studies of the blood in cases of "irritable heart" show nothing of significance that might assist in the diagnosis.

Lawbry and Esmein²⁰³ also investigated the leukocyte balance in irritable heart action. They found lymphocytosis in 22 out of 30 cases. They do not believe that there is any relation between the leukocyte formula and the degree of disordered action. In three soldiers with exophthalmic goiter the differential leukocyte count was normal.

McDougall²⁰⁴ reports the blood examination of 438 soldiers with special reference to the value of the leukocyte count in the diagnosis of trench fever. He found lymphocytosis during the apyrexial periods and polymorphonuclear leukocytosis during the pyrexial periods was the condition found in the regularly relapsing type of trench fever. Cases of regularly relapsing trench fever and of the influenzal type may merge gradually into the irregularly relapsing form. In the irregularly relapsing type there is no such definite fluctuation in the cells as is found in the regularly relapsing type. The existence of sustained lymphocytosis in the presence of a temperature swinging between 98° and 100° F., with symptoms of pain in the head, back and legs, especially in the shins, may be taken as typical of this form of trench fever. A normal differential blood count, in the absence of fever and subjective symptoms, McDougall holds may be regarded as proof of the absence of trench fever infections. A certain proportion of cases of irregularly relapsing trench fever show an excess of large mononuclear cells. These cases are accompanied by very intense shin pains. The influenzal type of trench fever in the mildest form of the disease. The total white cell count in the enteric type is moderately high. In addition, polymorphonuclear leukocytosis is present during the fever. These points serve as useful guides in the differential diagnosis from enteric infections. The vast majority of cases of D. A. H. following trench fever show lymphocytosis, but this is present before the onset of the D. A. H. Temporary accelerations of the pulse-rate when the patient is at rest in bed, and especially when he is afebrile, are evidence of a predisposition on the part of the heart for involvement in a more permanent instability. Trench fever can be separated from malaria and influenza by repeated blood examinations.

An interesting study of the leukocytes in infections has been reported by Audain,²⁰⁵ who found that when the infection is an organ or tissue abounding in lymphoid elements, the mononuclear white cells are the pivot of the defence. With an organ or tissue poor in lymphoid elements

²⁰³ Bulletin de la Société Médicale des Hôpitaux, 1919, xliii, 115.

²⁰⁴ Quarterly Journal of Medicine, Oxford, July, 1919.

²⁰⁵ Presse Médicale, 1919, xxvii, 216.

(like the cellular tissue, lung or blood), the polynuclear is captain of the defensive forces. The difference between the number of polynuclears or mononuclears and the normal figure is an index of the conditions which determine the prognosis. Thousands of examinations of blood specimens have confirmed the reliability of this *résultante*, as Audain calls it. For example, assuming as normal figures, 4900 polynuclear and 2100 mononuclears (that is, in 7000 leukocytes, 70 per cent. are polynuclears and 30 per cent. mononuclears), if the blood with 12,000 leukocytes shows 78 per cent. polynuclears to 22 per cent. mononuclears, then the polynuclear *résultante* would be $(780 \times 12) - 4900 = 4460$. The mononuclear *résultante* would be $(220 \times 12) - 2100 = 540$. With infection in organs scant in lymphoid elements, the prognosis is good with a *résultante* of 3000 to 8000, and very good from 10,000 to 16,000 and above. With infection in an organ or tissue rich in lymphoid elements (as in enteritis, typhoid, paratyphoid and tonsillitis), the prognosis is favorable if the *résultante* is above zero. Below minus 600 it is grave, and very grave at minus 2000 or below.

Audain insists further that the minimal temperature is what counts. The minimal temperature varies in inverse proportion to the *résultante* index. His studies of the behavior of the leukocytes in connection with the course of the infection have convinced him that treatment of infection should be focussed on means to increase the forces of the defensive leukocytes involved. Leukogenous medication should be our aim, and for this, sodium nucleinate, isotonic sugar solution, and turpentine are the main reliances.

The occurrence of transitional leukocytosis in chronic appendicitis was studied by Friedman,²⁰⁶ who found the following:

1. Transitional leukocytosis, or an increase in large mononuclears and in transitional leukocytes, or an increase in either of them, was found in the blood of 87 per cent. of patients in whom evidence of chronic appendicitis was obtained.
2. There was no transitional leukocytosis in the blood of patients in whom evidence of chronic peptic ulcer was obtained or in the blood of those in whom cholecystitis, renal stones or other organic abdominal conditions were found at operation.
3. A transitional leukocytosis was found in patients in whom appendicitis was present, with other organic abdominal conditions.
4. A hyperleukocytosis and a polynuclear leukocytosis are not as frequently found in chronic appendicitis as a transitional leukocytosis.
5. A transitional leukocytosis as a diagnostic aid is superior to such roentgen signs which are supposed directly or indirectly to point to a diseased appendix.
6. Transitional leukocytosis often persists in the blood after an appendectomy is performed.

Purpura. DeLange²⁰⁷ discusses the various forms of purpura and classifies them into two great groups, those in which the bloodvessels

■ ²⁰⁶ American Journal of Medical Sciences, 1919, clviii, 545.

²⁰⁷ Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, 1919, xviii, 1564; Abstract, Journal of the American Medical Association, 1919, lxxiii, 568.

are responsible and those in which the blood or the blood-producing organs are to be incriminated. The first group is the anaphylactoid type; the second group is the Werlhof disease type. Both types occur in a chronic intermittent form, an acute or a fulminating form, and the Werlhof type may occur as a symptom in leukemia, or other diseases of the blood. DeLange gives the minute details of 8 cases of these various types, 1 the acute infectious form of anaphylactoid purpura in a child under three after an infectious sore-throat and otitis. The blood-platelets numbered only 71,750, but in two weeks they ran up to 1,130,000 and then settled back to an average between 213,000 and 718,000. Recurring epistaxis and hemorrhages from the buccal mucosa were accompanied by petechiæ on the limbs and neck. The blood findings are tabulated over a period of six months, the hemoglobin only slowly increasing from 30 to 56 per cent., and the reds from 2,660,000 to 5,580,000. In one boy of twelve, there was in addition an intra-abdominal hemorrhage. Tubercle bacilli seemed to be responsible in this case. DeLange cites further a family in which apparently infectious purpura developed in parents, grandmother and three children, all within a few days, and running a mild course in all. Only one of DeLange's 8 cases was of the Werlhof type. This was in the young infant of parents both subject to epistaxis. There was nothing to indicate hemophilia otherwise, although there are many reasons for accepting a connection between idiopathic Werlhof's disease and hemophilia. The prognosis in this case seems grave; it may run into aplastic anemia.

Rabuffetti²⁰⁸ reports a case of severe purpura hemorrhagica which was cured by antisyphilitic treatment. Three cases of purpura rheumatica with gastro-intestinal disturbances are described by Lavergne²⁰⁹ in children from five to twelve years old. He states that whenever a child over five years develops abdominal pain with or without vomiting, the possibility of rheumatoid purpura should always be borne in mind, and the eruption should be sought for, especially on the legs near the malleoli where it is usually most intense. In the first case, sudden and lively pain in one knee and in the abdomen were the first symptoms. By the next day there was severe pain in the wrists, and the following day there was melena and a purpuric eruption on the legs. Then all the symptoms rapidly disappeared, but the fifteenth day the purpura alone returned. By the end of the fifth week the condition seemed to be entirely normal once more. In the second case the abdominal pain and occasional vomiting had kept up for a month, but there was nothing to call attention to any of the joints. About the thirty-third day slight eruption on the legs confirmed the assumption of purpura. It was so slight that it would have been overlooked if it had not been sought with special care. In such cases appendicitis is suspected, and if there is blood in the stools, melena or invagination is accepted. Palpation is so painful that the child will not allow it. In the third case

²⁰⁸ *Semana Medica*, Buenos Aires, 1919, 26; Abstract, Journal of the American Medical Association, 1919, lxxiii, 652.

²⁰⁹ *Paris Médicale*; Abstract, Journal of the American Medical Association, 1919, lxxii, 456.

only the elasticity of the abdominal wall spoke against appendicitis. As there was no eruption and no pains in joints, the diagnosis wavered only between chronic invagination and duodenal ulcer. The green fecaloid vomit, blood in the stools and the contrast between the pulse up to 120 and the normal temperature, with the intermittent character of the disturbances, were finally explained by the purpura eruption the sixteenth day.

Gordon²¹⁰ describes the clinical and anatomical findings referable to the nervous system in a case of hemorrhagic purpura. The patient, a male, five years of age, suddenly commenced bleeding from the mucous membrane of the mouth. The knee-jerks were markedly diminished and obtained with difficulty. There was no other abnormal reflex. The blood presented the following peculiarities: The platelets were diminished; the coagulation time was normal but the clot remained non-contractile, all circumstances distinguishing the condition from hemophilia. The patient was treated with transfusion of human blood, but without effect. A subcutaneous injection of thromboplastin also remained ineffectual.

Autopsy revealed multiple hemorrhages in many segments of the nervous axis, the process being confined exclusively to the gray matter. Gordon calls attention to the unexplained contrary phenomena, namely, the exclusive involvement of the gray matter in purpura in contrast to the involvement of the white substance principally in the severe anemias. He states that perhaps improvement in laboratory technic with regard to the vascular supply of gray and white substance will enable us to solve these interesting problems.

Blood Examination of Trinitrotoluene Workers. These columns have contained in the past several years reference to the blood examinations of trinitrotoluene workers. At times these observations have been contradictory. During the past year a very thorough investigation was reported by Minot of 233 workers exposed to trinitrotoluene with the view to ascertaining not only the character of the blood-changes, but also to see if the blood abnormalities which occurred would serve as an indicator of the degree of poisoning. As Minot²¹¹ states, it was well known that the most serious forms of poisoning with T. N. T. may result in death from a severe anemia of an aplastic type or, more frequently, from a severe toxic jaundice, associated at times with some anemia. The relations of these two conditions to each other has been disputed. However, it may be said that toxic jaundice has been reported with little or no changes in the blood picture. In a study of these cases which were unselected, it is evident that blood abnormality does occur frequently, even in the most minor grades of poisoning. Thus 83 per cent. showed polychromatophilia involving at least one cell in every six or seven oil immersion fields.

²¹⁰ *Journal of Nervous and Mental Diseases*, 1919, 1, 144.

²¹¹ *Journal Industrial Hygiene*, 1919, 1, 301. This investigation was undertaken as a part of a general survey of the T. N. T. manufacture in the United States at the request of the National Research Council, with the cooperation of the United States Ordnance and Labor Departments.

The total red cell abnormalities usually appear to run roughly parallel to the degree of symptoms, but in some instances marked symptoms may occur and the red cell and total blood abnormalities be slight.

The nature of the blood changes, beside alteration of the hemoglobin, are of at least two types: Destructive action of the red cells with increased marrow activity, later followed in some instances by marrow inactivity. It is rare to find definite evidence of aplasia, while cases showing symptoms suggesting toxic liver changes, together with blood abnormalities indicating red cell destruction and marrow activity, are distinctly common. Thus toxic jaundice is the most common form of severe poisoning to guard against.

Minot believes that evidence of red cell destruction is to be found in the histological examination of the blood especially in the finding of fragmented or fragmenting cells. All the cases with large numbers of fragmented cells showed signs of being distinctly sick, often they were slightly jaundiced, without bile in their urine. The data showed that it was decidedly unusual to have definitely sick cases with but few of these cells. Perhaps the absence of fragmented cells in the blood of individuals with definite symptoms of poisoning may be explained on the supposition that the rate or degree of destruction was not enough to allow such cells to appear in the circulation. It would seem that when they occurred in the circulation, destruction was taking place faster than the liver, or perhaps other organs, could take care of the destroyed blood.

Evidence of increased blood formation is plentiful. The probable stimulus to this is the increased oxygen-want caused by the altered hemoglobin, as well as the products of blood destruction, with later anemia itself.

There is some evidence to suggest that with very minimal amounts of T. N. T. entering the body, the red cells, polynuclears, and platelets, the three chief formed elements originating in the marrow, all may be maintained at the same time at a slightly higher level than normal. The possibility of increased red counts was pointed out by Panton and certain of our cases with minor symptoms had high counts (6,000,000), with increases of young red cells as well as increases of polynuclears and platelets. Such high counts did not occur in definitely cyanotic individuals. This stage of stimulation in which all the marrow elements are kept above normal, of course may not occur if the amount of poisoning or blood destruction is too great to permit it.

When the red-cell destruction exceeds formation, anemia ensues. This is of the so-called secondary type. Though hemoglobin estimations were not satisfactorily made, there was evidently often a distinct reduction, probably relatively more than the reduction of the red cells. The degree of the anemia runs parallel with the degree of red-cell changes. The average red count in the cases with the most marked blood abnormalities was 3,800,000. In the presence of definite anemia, as well as before the red counts are significantly reduced, there is a great effort on the part of the marrow to regenerate blood, as evidenced in the peripheral blood by the great frequency of polychromatophilia, fine stippling, reticulated cells, variation in sizes of the cells, etc. This is

also shown by the frequency of elevated white counts, with increases of polynuclears, and probably by frequent increases of eosinophils to over 5 per cent. Evidence of the activity of the megakaryocytes of the marrow is seen in increases of platelets. Varying conditions will, of course, give varying blood pictures of these different elements. At times an unusually marked strain appears to be placed on the marrow, so that what has been termed a lowered marrow threshold occurs, as evidenced in the peripheral blood by the occurrence of blasts, Howell-Jolly bodies, and perhaps atypical mononuclear cells and abnormal appearing polynuclears.

Evidence of the marrow's failing to act is probably first seen in relative increases of lymphocytes with absolute diminution of the polynuclears. It is suggested that a stage of stimulation of the lymphocytes occurs from this poison. Lymphocytosis *per se* should be looked upon as a distinct abnormality, but not necessarily as one that indicates something certainly serious unless there is a leukopenia also. Individuals exhibiting such a change, however, should be carefully watched, even if red-cell changes, symptoms, etc., do not indicate any significant poisoning. Further evidence of failure of the marrow is that to be found in diminution of the platelets. This, associated with absolute diminution of the polynuclears, is certainly to be looked upon as evidence of failure of the marrow. At the time when lessened activity of the platelet and white-cell elements occurs in the marrow, the red-cell elements still show marked activity. At a later time, with definite aplasia, which did not occur in any of the cases of this series, the red-cell elements will probably show little or no activity.

It is important to note that while definite poisoning is associated with definite changes in the red cells, poisoning may occur with about equal frequency with any combination of white-cell formula, though the lymphocytes may average slightly higher in such instances. Thus, more information concerning the worker's condition is to be derived from the red cells than from the white cells, though under certain circumstances as described, the white cells may yield some important information.

There is plenty of evidence at hand to show that if the individuals are removed from the poison when they have moderate symptoms and blood changes, the symptoms will disappear and the blood improve. Satisfactory data on the rate of the return to normal or to a definite percentage of normal, are not available. However, it is to be noted that removal from the poison may occur too late—the trap be sprung too far—so that the symptoms progress and fatal anemia or toxic jaundice ensues.

Minot believes that blood changes of the more marked degrees described should always indicate too severe a poisoning for an individual to be permitted to continue his given type of work, at least for the time being. We also feel that it cannot be considered wise to allow an individual showing a moderate but a persistent increased activity of his marrow, in the presence of anemia and blood destruction, to continue work for any length of time without having him run a risk of damaging his hematopoietic system to such a degree that complete recovery

would be difficult or perhaps impossible. It is, however, to be noted, that the duration of work shows no definite relation to the types of blood changes seen, and that blood changes are probably dependent upon the dosage of T. N. T. received and the individual's susceptibility rather than upon the time of exposure to the poison.

With any evidence of failure of the white cell or platelet elements of the marrow, an individual should undoubtedly be removed from his work, but evidence of this based on lymphocytosis *per se* should be carefully judged before considering it as a definitely serious sign.

The blood examinations should not be considered the only criterion on which to decide whether an individual should be permitted to continue his given job or not. Such decisions, according to Minot, should be made on frequent careful clinical observations of symptoms and signs, supplemented by blood examinations.

OPHTHALMOLOGY.

BY JOSEPH W. CHARLES, M.D.

THE work of ophthalmologists in the United States Medical Research Laboratories, as well as in the field, has been so well crystallized that many valuable papers have been produced, which, it is hoped, will assist not only the specialist, but also the general practitioner in solving the ocular problems of peace.

Some of the most valuable, *e. g.*, concerning the physiology of binocular vision, are too technical and too exhaustive for review.

Among these may be mentioned Captain Howard's¹ "Test for the Judgment of Distance," the result of his investigations of the vision of aviators at Hazelhurst Field, Mineola, N. Y., in which he found that the binocular parallax is the most important factor in our judgment of distance: Captain Cobb's² "Study of Dark Adaptation" and Wilmer's "Ocular Functions of Aviators." De Schweinitz on the "Ocular Phenomena in the Psychoneuroses of Warfare," Duane's "Eyes of the Signalman" and Derby's "Control of Trachoma in the Alien Labor Companies" will be read with profit by the general practitioner as well as the specialist, because of the possibilities of their practical application in the pursuits of peace. Foreign journals have not yet recovered from the stress of the past few years, and very little original work, and few cases of interest to the general practitioner have appeared, a large proportion of their space being occupied by abstracts from our journals.

Pituitary Headaches. According to Pardee,³ one is suspicious of the pituitary gland if a frontal headache does not yield to the usual remedies. Early affections of the hypophysis cause headaches, which are more common in women, and are mostly met in adolescence and early adult life. He notes their location, duration and persistence, as well as their relief by specific medication.

"The pain is frontal, 'deep in the forehead behind the eyes' and a patient will not infrequently indicate its position by placing a finger on each temple and pointing inward toward the hypophysis."

It may last several days and in the female it often comes on at the time of the menses, which are apt to be irregular and associated with excessive loss. It may be accompanied with nausea and vomiting.

The patient is weak, and dermatography is present as a sign of dyspituitarism. Periodically, the patients crave sweets, which seems to initiate the headache.

¹ American Journal of Ophthalmology, September, 1919; Transactions of the American Ophthalmological Society, 1919.

² Transactions of the American Ophthalmological Society, 1919.

³ Archives of Internal Medicine, February, 1919.

These patients have "dark, coarse abundant hair, with male distribution in the female and *vice versa*, the presence of a 'nasal eyebrow,' moustaches in the female, coarseness of the features, occasionally a contraction of the fields of vision, and rarely, primary optic atrophy."

This swelling of the hypophysis may be cyclical (menstruation), compensatory to other glandular disease, or caused by mental or traumatic shock. The sella is usually enlarged and the clinoids often eroded. Armour's tablets of pituitary, gr. $\frac{1}{4}$ to gr. ij, t. i. d., are given until improvement permits reduction of the dose to three or five times weekly. Failure to respond to treatment suggests a neoplasm.

J. Herbert Fisher⁴ uses the following argument that MIGRAINE IS INITIATED IN THE PITUITARY BODY. The primary classical symptoms are the scintillating scotoma, preceding the localized and usually unilateral headache, culminating in nausea or actual vomiting, and sometimes a marked reduction in the pulse-rate and marked increase in renal activity. There is periodicity about the attacks.

In females, the attacks often coincide with the menstrual periods, they often cease during pregnancy and usually terminate for good with the climacteric. In the male they usually cease when the patient is about fifty years of age.

The visual aura of epilepsy lasts for a few seconds only and is "a highly perfected visual sensation presumably originating in the cortex of the visual centers, whence the disturbance spreads to the motor and sensory cortex."

The migraine spectrum lasts from twenty minutes to a half-hour, is a lowly organized subjective visual phenomenon, and is always symmetrical. "It may be represented by a scotoma expanding from the central point of vision. It may first appear in the temporal periphery of the fields, or affect the homonymous halves of the two fields of vision.

"It is possible that this visual spectrum is produced by irritation of the visual nerve fibers at the base of the brain." Pressure at the chiasm could cause an expanding scotoma or a bitemporal scotoma. There would be a homonymous spectrum if one tract were involved and "the crude impulse initiated in the basal fibers would be to some extent elaborated by the gray matter of the cortex. That the hemicrania develops on the side opposite to the homonymous scintillating scotoma agrees well with the idea that the latter is initiated in the optic tract."

A lesion in the interpeduncular region can explain all varieties of the migraine scotoma and a very slight swelling of the hypophysis would be able to irritate the visual fibers in any of the required positions. The pituitary body undergoes profound modification during gestation and at the climacteric, as well as in males when the sex powers begin to wane.

(The adherents of the accommodative etiology of migraine use exactly this argument that migraine and accommodation begin to wane at the same time.)

Swelling of the hypophysis by raising the intracranial pressure could very readily cause the headache, slow pulse and vomiting. It is also

⁴ British Journal of Ophthalmology, June, 1919, No. 4, vol. iii, p. 241.

well known that injection of pituitary products causes reduced heart-beat and increased renal activity.

"If the central, bitemporal or homonymous scotoma became permanently established there would, I imagine, be little difference of opinion as to the site of the lesion."

Fisher believes that a periodic temporary swelling of the pituitary body explains all the symptoms of migraine, but the question is then in order what causes this "periodic temporary swelling?"

Illumination. The subject of the *illumination of school-rooms, office buildings, etc.*, has not received the attention it deserves.

Jackson read before the Ophthalmic Section of the American Medical Association (p. 176) a paper full of valuable suggestions concerning "Daylight Illumination of Interiors."

"Every attempt to improve the quality of artificial light has been in the direction of making it more like daylight," while very little effort has been made to improve our means of utilizing daylight itself.

"The source of illumination should be above. With daylight illumination outdoors the arrangement is ideal. For interior illumination the problem is as nearly as possible to reproduce the outdoor arrangement."

The ordinary window gives an unequal light to different parts of the room. Prismatic glass windows are an advance, but they throw the light in a horizontal direction.

A reflection of daylight on a light ceiling would seem to be the logical solution of the problem. It could be placed outside or inside, or partly outside and partly inside, the window. They should be above the plane of the eyes.

White enamel glass is a very satisfactory reflector. The ceiling should approach white and "give back well the middle colors of the solar spectrum."

Shades from the bottom or at the middle of a window seem to be the best arrangement.

REPORT OF THE BRITISH COMMITTEE OF OPHTHALMOLOGISTS ON A STANDARD ILLUMINATION OF SNELLEN'S DISTANT TEST TYPES. The British committee⁵ of ophthalmologists reports the following standard:

The minimum illumination shall be three-foot candles (a foot-candle being the illumination from one candle-power falling upon a surface one foot distant) and as uniform as possible. Therefore, artificial illumination is preferable.

The testing room should be moderately illuminated. There should be no glaring lights or bright objects in the candidate's field and the test-card should not be greatly contrasted from the background.

The method of lighting should be from two "20-watt tungsten lamps, with straight filaments fixed vertically in front of the plane of the test-card, one on each side at a horizontal distance of twelve inches from the vertical plane normal to and bisecting the card. One lamp is placed higher than the other, being opposite the junction of the upper and

⁵ British Journal of Ophthalmology, January, 1919, No. 1, iii, p. 22.

middle thirds of the card, the other opposite the junction of the middle and lower thirds." These should be screened from the view of the patient.

INJURY OF THE EYE DUE TO LIGHT. Van der Hoeve⁶ gives the following summary of his observations and study:

1. The lens is optically heterogeneous; it disperses, consequently, the ultraviolet rays considerably.

2. Light with many ultraviolet rays can cause changes in the ciliary processes and the retina; in the ciliary processes the changes are caused by the diffuse dispersion of these rays in the lens; in the retina one of the principal factors for the formation of senile intraocular degeneration is the influence of these rays.

3. An important factor in the formation of senile cataract are changes in the nourishment of the lens following disease of the ciliary epithelium, which are caused by light containing many ultraviolet rays.

Zona Ophthalmica in a Child. Gallemaerts⁷ reported a case of eruption on the face three weeks before admission to the hospital. The child had been well and had no gastric disturbance. The eruption occupied the upper left half of the face and extended in the scalp to the parietal region. It was characterized by necrotic plaques, which bled abundantly on removing the thick black crust which covered them. There were some bullæ, especially in the scalp. No eruption on the nose. There was one large central corneal ulcer and abundant conjunctival secretion. The eruption was a herpes of the superior branch of the trigeminus, which spared the nasal branch.

THE CONJUNCTIVA.

The Open Examination of the Upper Conjunctival Cul-de-sac. The older methods of searching for foreign bodies in the superior cul-de-sac by means of blunt curettes or probes introduced under the everted tarsus was so unsatisfactory that it was superseded by the method of pressing the globe back by means of the finger placed on the lower lid after the upper lid had been turned; the retrotarsal fold comes forward and can be inspected for foreign bodies or treated for trachoma. Considering the danger of too long-continued pressure on the eyeball, Terson⁸ raises the everted upper lid with a strabismus hook or forceps while the patient looks down, or, better still, after subcutaneous injection of cocaine or allocaine he has the patient lie down and after ten minutes seizes the lid horizontally with forceps and rolls out the cul-de-sac entirely by turning the lid on the forceps.

Phlyctenular Conjunctivitis. Milne⁹ reported 2 cases of recovery from phlyctenular disease after the removal of adenoids which had not been improved by the usual local treatment, proper glasses and general tonics. A boy, aged four years, with intense photophobia and blepharo-

⁶ Archiv f. Ophthalmol., 1918, xcvi, p. 49.

⁷ Annales d'Ocul., March 3, 1919, clvi, 128.

⁸ Arch. d'Ophth., January and February, 1919, No. 7, xxxvi, p. 437.

⁹ British Journal of Ophthalmology, April, 1919, p. 163.

spasm for eighteen months, had typical phlyctenules in both eyes. On the morning following removal of his tonsils the patient was found sitting up before a window looking at picture books and the phlyctenules disappeared in three days without recurrence in a year.

A girl, aged eleven years, had been treated for fifteen months for headache, photophobia and lacrimation. Correct glasses had been given. Well-marked phlyctenules were found. The case did not improve for two months, when treatment was discontinued for two weeks and the tonsils removed. In less than three weeks the eye was clear.

Turner¹⁰ believes that phlyctenular ophthalmia is due to a "chronic low-grade infection of the ethmoidal labyrinth, with obstruction to drainage." He thus explains its frequent unilaterality and the fact that it often follows the acute infections of childhood, which often cause ethmoidal involvement. Some children remain robust because they are more resistant than the eye to the toxins which are absorbed from the local focus. Diseased tonsils and adenoids produce an intumescence of the soft parts above, thus creating an obstruction to sinus drainage, and intestinal and other toxemias increase an already present swelling or intumescence.

The disappearance of the tendency after adolescence he attributes to the development and widening of the nasal chambers, which relieves the obstruction to sinus drainage.

Bell maintains that phlyctenular disease is often due to gastrointestinal disturbance and that over-indulgence in sweets, bad teeth, as well as tonsils, and adenoids are the principal factors.

It must be remembered that twenty-five years ago it was not uncommon to tell mothers that these children had "candy sore eyes," and the treatment was castor oil or calomel and the syrup of ferrous iodide, with stimulating treatment of the eye (silver nitrate, calomel dusted into the eye and the yellow oxide of mercury ointment). However, there were cases which did not respond to this treatment, and these obstinate cases were the ones which seemed to recover most rapidly under tuberculin injections.

Trachoma. SCAR-TISSUE CONJUNCTIVITIS IN ANIMALS—ITS RELATION TO INSECTS AND TRACHOMA. F. T. Eaton¹¹ states there is in Illinois an equine scar-tissue follicular conjunctivitis, with entropion, similar to trachoma in man, with facts pointing to its origin from horse-flies, which bite the eyelids of horses at the inner canthus.

For years the Indians were supposed to be immune to trachoma, but Harrison,¹² of the United States Indian Service had found only one band, on the North shore of Lake Superior, of 346 Chippewas, wholly free, and these Chippewas did not have the number of horses and cattle usually possessed by most Indians.

Sulzer¹³ ascribes the immunity of the Swiss to the high altitude of the country, but there are also very few horses in Switzerland.

¹⁰ American Journal of Ophthalmology, February, 1919, p. 115.

¹¹ Ibid., p. 81.

¹² Ophthalmological Record, 1913.

¹³ Bulletins et Mém. de la Soc. Franç. d'Ophth., vol. xiv.

The regions in this country where trachoma is endemic, as Southern Illinois, portions of Kentucky and West Virginia, abound in streams. These furnish typical breeding ground for horse-flies, which breed in water and wet soils and which cannot live far from water.

Eaton, from an extensive ophthalmic practice in the Pacific Northwest, tabulated all cases of trachoma coming to him from Oregon, Washington and Idaho. The vast majority were farmers, stockmen and stablemen, the last predominating. He was then unaware that in Hungary stables are popularly held to be a source of trachoma.

"If it could be accepted, the hypothesis that animals and certain species of horse-flies (*Tabinidæ*), *when both are present in a region where trachoma and animal scar-tissue conjunctivitis are endemic*, stand in etiological relation to the human disease, would harmonize a considerable number of observed facts, which render it the most promising theory on which to base a systematic search for the source in nature of the disease."

In stables and barnyards the horse-fly outnumbers the biting stable fly, and they may dung upon the hands, and infection could be carried thence to the eyes.

THE TREATMENT OF TRACHOMA has usually been based on the attempt to hasten elimination and absorption by remedies which stimulate or by operation which actually removes the contents of the follicles.

Howley¹⁴ has added a new method of emptying the follicles by means of "negative pressure," contending that his suction method is the best possible way of abstracting the secretion and infection from the conjunctiva.

The apparatus is a glass tube applicator fitted at its middle with a bowl for catching and retaining the secretion. Suction is produced by any good pump. He has discarded the vacuum gauge and has substituted for it the finger on the opening of the applicator.

Under cocaine, he first scarifies or scrapes the granulations of obstinate cases and then passes the applicator over the surface, sucking up secretion and blood into the bowl. In his mild cases he has used negative pressure two or three times a week, followed by bichloride, 1 to 5000, or argyrol, 20 per cent. He also uses silver nitrate, 1 per cent. or 2 per cent.

Howley also treats in the same manner chronic conjunctivitis that has resisted ordinary methods and has found that these cases yield much more rapidly.

DETACHING OF THE BULBAR CONJUNCTIVA AS A TREATMENT OF TRACHOMATOUS PANNUS. Trachomatous pannus has been attacked by painstaking attempts at obliterating the conjunctival vessels supplying it, either separately or by peritomy, tarsectomy, removal of a flap, cauterization, etc.

Hiwatari¹⁵ has devised a new method of detaching the bulbar conjunctiva. After disinfection, 0.5 or 1 c.c. of 1 per cent. cocaine is injected under the fornix or its neighboring conjunctiva. A flat incision is made

¹⁴ American Journal of Ophthalmology, March, 1919, p. 180.

¹⁵ Ibid., No. 3, vol. ii, p. 183.

parallel to the upper margin of the tarsus from canthus to canthus through the tarsus or bulbar conjunctiva. Three suture loops are introduced through the lower lip of the wound, by means of which an assistant assists in detaching the conjunctiva. "The detaching must be extended also toward the median and lateral sides of the cornea if the bloodvessels run into the pannus from those sides." "The incision wound of the conjunctiva is sutured continuously toward the inner and outer canthi by means of the middle loop. Fixation of each end of the suture thread on the skin of inner and outer canthus is made with adhesive plaster and a bandage." The suture is removed in four days. "The complete disappearance of the bloodvessels in my operated cases must be ascribed to the favorable effect of the operation."

CONTROL OF TRACHOMA AMONG THE ALIEN LABOR COMPANIES OF THE BRITISH AND AMERICAN EXPEDITIONARY FORCES. Colonel Derby described before the Ophthalmic Section of the American Medical Association in June the measures deemed necessary by the ophthalmologists in charge of our alien labor companies.

The danger of the spread of trachoma in armies has again been emphasized by Eason,¹⁶ and the alien laborers, notably Chinese and Egyptian, have been closely observed and treated.

Colonel Lister's latest figures were about 8500 cases of acute trachoma and 5500 cases of suspicious conjunctivitis.

The British followed this plan: Upon arrival, the lids of each Chinese were turned and inspected. If they were healthy, the man was assigned to a clean or "X" company. If conjunctivitis was present, to a "Y" company as were also doubtful trachoma cases, and trachoma cases to a "Z" company. Clean companies were sent anywhere with occasional inspections by ophthalmologists, who weeded out a few cases which appeared later. Y and Z cases were treated "in trachoma treatment-centers." Even the clean companies were treated once daily with zinc sulphate and boric acid after the days' work. The milder cases in Y companies were treated in the same way, while severe conjunctivitis cases received silver nitrate or protargol. Trachoma cases and corneal ulcers were treated as in civil life. Each Chinaman's towel was sterilized twice weekly. By this method there was almost no loss of efficiency. No case of spread of contagion to troops or civilians was noted.

The methods of the Americans followed those of the British—isolation and treatment of the trachoma and conjunctivitis companies and careful supervision of all others. The few cases of trachoma among our soldiers were treated in the hospitals.

Ophthalmia Neonatorum. Allport¹⁷ emphasizes the extreme care in prophylaxis and treatment with which these cases should be handled.

Since 20 per cent. of the blind in the United States and about 25 per cent. of the inmates in blind asylums can be attributed to this disease, and \$400 a year are necessary to educate and care for a blind child, the fifty blind schools in this country cost about \$2,000,000 a year, and ophthalmia neonatorum costs the country about \$7,000,000.

¹⁶ Ophthalmological Society of the United Kingdom, 1918.

¹⁷ American Journal of Ophthalmology, March, 1919, p. 207.

The Credé treatment for all newborn children would almost eliminate this disease and its dreadful consequences, and it should be understood that gonorrhea is not the only condition that will produce it, but that it may occur from other and non-disgraceful causes.

Fully one-half of the confinements are necessarily attended by midwives; these should be educated, examined, licensed and inspected, and should always call in medical assistance in complicated cases. Births, with the ocular condition, should be reported within a few hours, and suitable laws should be passed providing for the invariable use of the Credé prophylaxis with proper penalties for their infraction.

Every legitimate method of educating the people, the midwives and the doctors, should be encouraged.

It is certain that no remedy can now take the place of nitrate of silver, which is provided fresh to doctors and midwives by some large cities. A small hospital or special wards prepared day and night to provide expert medical attendance and proper care should be established in every large city for the prompt reception of such cases, and health departments should employ an experienced eye nurse to search out and follow up cases of this disease.

Great benefit can be accomplished by the free and frequent distribution of brief and pointed pamphlets, printed in several languages by some central organization, such as the National Committee for the Prevention of Blindness.

Subconjunctival Cysticercus. Gallemaerts¹⁸ described, in 1897, a case of subconjunctival cysticercus and now reports¹⁹ 2 additional cases.

The first was a child, aged five years, in good health, whose left eye had been red for eight days, the parents noticing a small knob or button at the angle of the eye between the insertions of the superior and internal recti. It was increasing in size and then measured 2 cm. in diameter and 5 mm. high. At first it was shining, but now it was quite red, slightly translucent, soft and not lobulated. There was no ulceration. The conjunctiva was thickened in the neighborhood and adherent to the tumor. A large subconjunctival vessel extended from the cul-de-sac to the growth which was adherent to the sclera.

Because the affection was acute, Gallemaerts could exclude a dermoid, a serous cyst, a lipoma and a malignant tumor. The dermoid lies partly on the cornea, partly on the conjunctiva and is congenital; lipoma is yellowish, with no injection, and lies between the superior and external recti; a malignant growth develops more slowly, lying on the limbus; a serous cyst is transparent, with no vascularization. Operation revealed a complete cysticercus.

The second case, a boy, aged eight years, complained of pain in the left eye several weeks before redness appeared toward the external canthus, which in five days increased and an abscess appeared at the angle of the jaw. On admission, a tumor, 12 mm. in diameter and 5 mm. in height, was seen between the external and inferior recti. This was violet in color and covered by strongly injected conjunctiva, which

¹⁸ Bull. Ac. de Méd. de Belgique, July 13, 1897.

¹⁹ Annales d'ocul., March 3, 1919, cli, p. 125.

extended to the cornea in fine circumcorneal vessels. A large conjunctival vessel emptied into it. The preauricular gland was enlarged.

Operation revealed an invaginated cysticercus measuring 10 mm. by 6 mm.

Tuberculosis of the Conjunctiva. Patterson²⁰ exhibited a case of tuberculosis of the conjunctiva in a boy, aged thirteen years, whom he had first seen in September, 1918, with a history of enlargement of the parotid for some weeks. The conjunctival trouble had existed all summer and had been treated with argyrol by the family physician.

The upper lid was thickened, there was a large tumor mass high up under the lid, and two small red elevations on the bulbar conjunctiva near the caruncle and one in the lower cul-de-sac. The upper part of the parotid was greatly enlarged, as was another gland below the malar process.

Forcible eversion of the upper lid (under a general anesthetic given for the removal of tonsils and adenoids) revealed a tarsal surface covered with large masses of granulation tissue, many of the granules surmounted with suggestive pale yellow spots and a deep ulcer 3 mm. in diameter near the center of the lid. Scrubbing "with gauze exposed very tough edges of a linear ulcer extending horizontally along the entire tarsal surface, the ulcer already referred to being, as it were, the bottom of the crater. The hard edges were trimmed smooth with scissors and cauterized with silver nitrate." The diagnosis of tuberculosis was confirmed by the microscope. Local applications caused only slight improvement, and on November 9, the administration of $\frac{1}{100000}$ mg. O T once a week was begun and gradually increased until $\frac{1}{50000}$ mg. was being given at the time of the report. After the first two injections there was a slight local reaction, and after each dose some lessening of the glandular swelling, but there was extension of the process inside the lower lid.

Lime-burns of the Eye. Chlorinated lime is becoming more and more popular in the household. An editorial in the *Journal of the American Medical Association*, December 6, 1919, p. 1769, states that 20 cases of burns of the eye were brought to the attention of the National Committee for the Prevention of Blindness in July and August, all of them caused by the explosion of gas inside of the can when the container is opened, thus throwing a shower of lime into the eyes. This accident can be avoided by punching a hole in the container before the top is taken off the can.

Treatment consists in the usual local anesthetic, followed by removal of all visible particles of lime and neutralization at once by a weak vinegar solution. Cold applications and boric acid every few hours may be necessary to control the resulting pain.

Vernal Catarrh. FREQUENCY OF VERNAL CATARRH. Fernandez²¹ gives the statistics of the frequency of vernal catarrh: Danvers, at Parma, had 50 cases among 22,398 patients; Schoebel, at Prague, 23 in 20,000; Schiess-Gemasens, of Basle, 14 in 33,609; and Kabli, of

²⁰ Colorado Ophthalmological Society, reported in *American Journal of Ophthalmology*, May, 1919.

²¹ *American Journal of Ophthalmology*, April, 1919, p. 241.

Petrograd, 2 in 20,690. In 61,000 patients in Cuba, Fernandez has seen only 6 cases.

THERAPEUTICS OF VERNAL CATARRH. Because the most notable histological lesion in exuberant pericorneal conjunctivitis is the proliferation of epithelial cells in the bulbar portion, and of the conjunctiva in the tarsus, with an infiltration of small cells, attention has been directed toward those remedies which act on the new tissue in addition to stimulating normal tissue.

Gonzalez²² uses for this purpose x-rays of quality 6 to 7 of the Benoist radiochromometer, the tube being focussed with an automatic regulator furnished with a protecting screen and localizing diaphragm. Children's eyes being more susceptible than those of adults,²³ exposures are limited to eight minutes, with the eyes open and the lids everted in tarsal cases, as a rule, every three weeks. In a few days exacerbation follows and in fifteen days improvement is expected.

Luedde²⁴ reports success in the treatment of vernal conjunctivitis with fibrolysin. He instils one or two drops of the solution daily into the conjunctival sac in the same strength as it is supplied in ampoules for hypodermic injection. His observations indicate that its use stimulates the subconjunctival lymphatic circulation.

AMETROPIA AND KERATOCONUS CAUSED BY VERNAL CATARRH. Gonzalez²⁵ is convinced that a number of cases of transition from emmetropia to ametropia, and especially compound irregular myopic astigmatism, which follows vernal catarrh, were caused by this disease, because of these three reasons: The appearance of vernal catarrh in children when the eyes are still developing; the nutritive modifications which must accompany the pericorneal infiltration; and the mechanical influence of pressure and rubbing through the closed lids in order to relieve itching. He also has seen marked cases of keratoconus follow the same disease.

THE CORNEA.

Keratitis Due to Melinite. Perrin²⁶ has observed 32 cases of this peculiar form of keratitis, which have recovered completely. The patients, workers in melinite, first notice a slight disturbance in vision, which increases. The cornea is infiltrated especially in its central and lower portions. The superficial infiltration is "milky," or, as if the cornea had been powdered and is triangular, with the apex near the limbus. There is no circumcorneal injection or vascular reaction—in fact, none of the phenomena which accompany acute or subacute keratitis—no pain, some itching and tickling. The affection is bilateral and all other parts of the eye are normal. The central vision is much poorer than the peripheral; the fields are normal; there is no dyschromatopsia.

²² American Journal of Ophthalmology, April, 1919, p. 235.

²³ Le Prince: Précis d'électroth. and de Radiothérapie Oculaires, Paris, 1911.

²⁴ Thesis, Transactions of the American Ophthalmological Society, 1919.

²⁵ American Journal of Ophthalmology, April, 1919, p. 233.

²⁶ Annales d'Oculist., March 3, 1919, clvi, p. 160.

All patients looking at a bright light see a characteristic halo, which is composed of three colors; at the center green, then yellow and more peripherally red. There was no intra-ocular hypertension. Treatment consisted of yellow oxide ointment, collyrium of methylene blue, and irrigation with borax. Duration six to nine weeks. Due to the vapors of melinite, industrially it may be classed as an "accident of work."

Gas Infection of the Cornea. In 1909, James²⁷ reported the clinical history and bacteriology of a case of gaseous panophthalmitis, and in the *Ophthalmic Review*, xxix, p. 161, a second case with references to the literature.

Pringle²⁸ has seen 3 cases which followed gunshot wounds of the eye.

The rarity of the infection in face injuries is attributed to the good blood supply and the fact that dirty clothing is not carried into the wounds, and in the case of the eye there is added the fact that the conjunctival sac is not a favorable situation for the culture of anaërobic bacteria.

A striking feature in Pringle's cases was the rapid involvement of the cornea, in each a matter of a few hours; in the third case the upper third of the cornea was infiltrated in forty-five minutes. In this case alone was he able to obtain a thorough bacteriological report which showed streptococcus, staphylococcus, *B. perfringens* and *B. sporogenes*.

Pringle was able also in this case to see a double row of gas bubbles along the upper edge of the infiltrated area as well as to observe the bursting of one of them.

THE IRIS.

Irregularity of the Pupils. T. Stewart Barrie²⁹ examined the eyes of 326 men sent up for special examination, finding 35, or 10.73 per cent., with unequal pupils. There was no disease in the eyes or central nervous system. All pupillary reactions were normal, the inequality persisting in the contracted state.

His conclusions were that:

1. Inequality of the pupils is frequent.
2. It is associated with all refractive conditions, with a tendency to be more frequent in myopic conditions.
3. The visual acuity is not affected adversely by the fact that one pupil is slightly larger than the other.
4. The left pupil is more frequently larger than the right.
5. Inequality of the pupils occurs as a physiological condition.

Without doubting the accuracy of Barrie's results, it would seem that probably many of these cases were sent up from a much larger number of men who had been passed by the general draft boards and therefore 10.73 per cent. could not possibly represent a fair proportion of unequal pupils to the greater numbers of men examined.

²⁷ Transactions of the Ophthalmological Society of the United Kingdom, xxx, p. 179.

²⁸ British Journal of Ophthalmology, March, 1919, p. 110.

²⁹ British Medical Journal, Abstract, Journal of the American Medical Association, vol. lxxii, 1867.

Conclusions based upon examination of recruits must be drawn conservatively or great harm may be done by their too ready acceptance.

Alert practitioners should not consider unequal pupils physiological until syphilis and disease of the central and sympathetic nervous system, as well as ocular disease, have been excluded.

Dujardin and Rasquin,³⁰ after investigating "The Relation of Syphilis to Irregularity of the Pupils" in 265 persons, concluded that: Pupillary irregularity is frequent in syphilis, especially in the secondary period. It may be the only pupillary symptom in syphilis of long standing. All cases of irregularity have 70 per cent. chance to be syphilitic.

THE LENS.

Cataract. T. Harrison Butler³¹ gives statistics of 250 cataract operations, with a net result of 87 per cent., useful vision, —50 per cent. having 6/12 or better.

Sixteen eyes (6.4 per cent.) were lost, the majority of the 16 occurring before he realized the necessity of removing septic teeth and examining the flora of the conjunctiva.

Of these, 9 were from iridocyclitis, 4 of these being in diabetic patients; 2 followed discission; 3 developed panophthalmitis; 1 sympathetic ophthalmitis.

Iridocyclitis, which did not destroy useful vision, occurred in 14 cases. This number added to the 9 cases above noted gives a total incidence of this disease in 9.2 per cent.

The author lays stress on the importance of general study of the patient for some days in the hospital, prior to operation, especially as regards teeth, urine, lacrimal sacs and the number and species of microorganism appearing on culture. His rule is to reject a case which gives a luxuriant growth of any microorganism, though he operated in the presence of a few colonies of *Staphylococcus albus* or *citreus*.

Operation is refused when culture grows *Staphylococcus aureus*, *streptococci* or *pneumococci*.

CATARACT FOLLOWING THYROIDECTOMY. Walter Edmunds³² has reported cataract following experimental thyroidectomy in the dog, and a few cases of human cataract have been recorded which followed removal of the thyroid.

Jeremy³³ reports the case of a woman, aged fifty years, who was admitted with a swelling of the neck which had appeared only seven weeks previously and had increased rapidly. The patient proved to have a solid cuboidal and giant-cell medullary carcinoma which necessitated the removal of the right lobe, the isthmus and a portion of the left lobe.

Three or four months after the operation vision began to fail and the patient was found to have cataract in both eyes without any manifest

³⁰ *Annal. d'Ocul.*, February, 1919, p. 89.

³¹ *British Journal of Ophthalmology*, July, 1919, p. 317.

³² *Proceedings of the Royal Society of Medicine*, February, 1916.

³³ *British Journal of Ophthalmology*, July, 1919, p. 315.

uveitis. The patient was stout and looked myxedematous. She was very feeble, unable to walk without support and complained of tetanic spasms in the legs.

It would be difficult to prove that the removal of the thyroid in this case had anything to do with the cataract. In the first place the patient was of sufficient age to expect lens changes and her health was sufficiently impaired to cause a deficiency in nourishment of the lens. The important circumstantial evidence in the case is that Coats has found after thyroidectomy in the dog "a certain amount of infiltration of the ciliary processes, with loosening and tightening of the pigmentation of the outer layer of the epithelium" and "the aqueous contains a good deal of fibrinous coagulum, perhaps indicating an alteration in composition." Of course, if that occurred in every human thyroidectomy one would expect cataract after the operation much more frequently than has been reported simply from nutritional changes, but the paucity of reports on this subject from so many operators who are alert for complications following their work is positive evidence against this theory.

NON-OPERATIVE TREATMENT OF SENILE CATARACT. In private practice a smaller proportion of old people who have been in the hands of competent oculists come to operation than occurred thirty years ago. Whether the education of our middle-aged patients to wear needed distance-glasses, thus avoiding strain with its attendant congestion of the ciliary body, is a factor would be difficult to say because the conscientious ophthalmologist also insists upon a general overhauling of many presbyopic patients as soon as he has seen their fundi and bloodvessels; and general conditions which might well cause cataract through a uveitis are frequently found by our internists, rhinologists, etc., before great damage has been done.

Risley³⁴ has written a timely article on "Diseases of the Uveal Tract," with special reference to handling incipient cataract as if it were caused by a uveitis (p. 108). For years he has treated these cases with correction of the ametropia, cycloplegics and amelioration of general ailments, with gratifying results. In 1889 he took 60 cases as the basis of a paper (*Universal Medical Magazine*, March, 1889) and many more cases have since been arrested: "Indeed, it was a rare exception for one of the cases so treated to return for operation."

NON-OPERATIVE TREATMENT OF CATARACT. Green and Green³⁵ believe that in 80 per cent. of their cataracts in which the treatment of Colonel Smith (subconjunctival injections of mercury cyanide) was begun before vision had fallen below 50 per cent. of normal, opacification has been checked or the vision even improved. Their results are only partially convincing and one would expect that the severe pain following the treatment would make a difficult patient to handle when the unimproved cases returned for operation.

RADIUM TREATMENT OF CATARACT. Reasoning from the bases that the capsular epithelium is the starting-point of cataract, and that radium produces "Various and deep changes in cellular functions," Cohen and

³⁴ *American Journal of Ophthalmology*, February, 1919, p. 104.

³⁵ *Ibid.*, June, 1919, p. 423.

Levin³⁶ published their results in 24 cases of lens changes. The protection of the eye from the irritating or caustic alpha and beta rays was insisted upon.

In spite of the repeated and painstaking examinations made under similar conditions, their very favorable conclusions must be accepted with some reservations. "Every cataractous eye is also a sick eye"—actual vision may improve or become worse, with stationary, or better or worse, opacification according to the condition of the fundus and also the mental alertness and visual training of the patient.

INDICATIONS OF PROBABLE ALTERATIONS OF THE RETINA BEHIND A CATARACT. When patients are sent to the ophthalmic surgeon for operation of cataract, it becomes necessary to determine whether an operation will be of benefit.

Cantonnet³⁷ records the following signs of probable alteration of the retina, which cannot be examined with the ophthalmoscope through the opaque lens:

1. If the cataract is unilateral without incipient changes in the lens of the other eye.
2. If the individual is young.
3. If the iris is discolored or synechiæ present.
4. If the lens is clear white or yellowish instead of grayish.
5. If the eye has been incapacitated several months or years by a traumatism (penetrating foreign body, contusion) which may have caused retinal detachment, to which the cataract is secondary.
6. If the eye has external strabismus; an old concomitant strabismus signifying a mediocre result, while an excessive strabismus with exanopsia, indicates a very poor prognosis. When perception of light has been lost, an operation will be of no avail.
7. If tension is not normal, but increased or diminished.

The signs of disturbance in the visual (neuroretinal) paths are loss of pupillary reactions and of light projection.

THE OCULAR MUSCLES.

Conjugate Deviation. Riley³⁸ reports a case of Conjugate Deviation with Astereognosis in a man, aged thirty-three years, who in December began to have "disturbed sensation in the right hand with inability to recognize objects by palpation. No muscular weakness." In March, the right eye was drawn to the right and a week later the left eye turned toward the right. Slight dizziness, no headaches. The left pupil was larger than the right. Patient had a heavy cold with fever in January. There had been a steady improvement until now the eyes can be turned as far as the midline. The sensory changes indicate a lesion on the left side of the brain "high up in the brain-stem;" added to this fact, the turning of the eyes to the right indicates an "irritative supranuclear lesion of the oculogyric pathway; the added dilatation of the left pupil,

³⁶ Journal of the American Medical Association, 1919, p. 1193.

³⁷ Jour. de Méd. et de Chir. pratiques, June, 1919.

³⁸ Archives of Ophthalmology, July, 1919, p. 340.

a lesion in the emergent fibers from the nucleus of the third nerve," "sweeping ventrally through and around the red nucleus and passing through the mesial extremity of the mesial fillet where are located, at this level, largely the fibers carrying impulses of a discriminating character." "In this part of the fillet can also be found the caudally directed aberrant pyramidal fibers, the pes lemniscus superficialis destined for the sixth cranial nerve nucleus of the right side." The inflammatory or hemorrhagic lesion is such as has been observed in epidemic encephalitis.

According to Holden,³⁹ the interpretation of these paralyzes lies in the fact that "The pontine and principal center of ocular gyration to one side is the abducens nucleus, which through the posterior longitudinal fascicle, controls the internal rectus of the opposite side." An extension of a lesion laterally or dorsally from the abducens nucleus would involve the facial nerve, and extension ventrally the motor pyramidal tract; so that many of the patients later have a facial palsy of the same side or a muscular weakness of the body on the opposite side.

The Maddox Rod Screen Test. Orthophoria, or correct muscle balance, was considered so important to the safety of the aviator, that the tests for the discovery of heterophoria were thoroughly investigated by the Ophthalmological Department of the Medical Research Laboratory at Mineola.

Dolman⁴⁰ reports that for the sake of compactness all were eliminated except the Maddox rod screen and parallax tests.

The simplicity of the ordinary Maddox rod seemed to be preferred until the following objections were discovered: In many cases more *esophoria* was shown than with the screen and parallax tests. This was caused: (1) by a latent hypermetropia, which necessitates correction with proper glasses during the test; (2) by a tendency to false projection of the line so that the observer must be trained to keep his attention on the light.

Tendency to fusion of the sufficiently dissimilar images of line and light is increased by: (1) The exclusion of extraneous retinal images, which may be caused by darkening the room too much. (2) Horizontal and vertical lines in the background, *e. g.*, edges of door and window casings, of the cabinet itself, or the vertical standard carrying the light. (3) Additional sources of light especially active when the room is dark.

Instability of the line, which "wavers" or "dances," can be avoided by fixing the attention upon the light or upon the line alone.

Inability to see the line results from:

1. Malposition of the Maddox rod. The closer the rod is to the eye the more distinct the line.

2. Bright illumination of the room, which should, therefore, be semi-darkened.

3. Dimness of the spot of light, which should be bright but diffused by ground or milk glass.

4. Non-essential sources of light, which should be eliminated.

³⁹ Archives of Ophthalmology, July, 1919, p. 372.

⁴⁰ Transactions of the American Ophthalmological Society, 1919.

5. Poor vision of one eye; therefore, place the rod over the better eye.

6 and 7. Habitual suppression of one image and poor vision in both eyes, may cause failure of the test entirely.

The Maddox rod screen test (at six meters) is facilitated by a double multiple Maddox rod and a double rotary prism in a phorometer trial frame, which is close to the eyes and horizontally adjusted. The room must be semi-darkened until the line can be seen readily. The screen-card is moved from one eye to the other a few times in order to be sure that both light and line are seen. The measuring prism should be before the eye with the Maddox rod so that the eye which fixes the light is in the primary position. The screen is placed before the rod so that the observer fixes the light with the other eye. It is then removed an instant (in which the line is located) and then quickly replaced. After a few brief exposures the observer rotates the prism until the line coincides with the light and the reading on the prism of the deflection is accomplished.

Operation for Advancement. Huizinga⁴¹ operates for the advancement of an ocular muscle by severing its tendon close to the globe, grasping it with an advancement forceps, turning back the end on itself beneath the muscle, and suturing it so as to form a loop through which a doubled armed thread is passed, the needles of which are then passed through the stump remaining attached to the sclera, and partly through the sclera. He claims that the sutures cannot give way when the operation is performed correctly.

REFRACTION.

Myopia in School Children. Ernest Thompson⁴² finds that while in certain cases there is a distinct heredity, in other cases there is no trace of it. In cases in which no hereditary tendency can be found, one or more of the generally accepted factors, *i. e.*, convergence strain, bad lighting, bad hygiene, physical strain, weakness of the sclerotic, etc., may have to be invoked.

The weakness of the sclerotic, caused by tubercle, is, in the author's opinion, a rather attractive hypothesis, though he has not yet found it possible to correlate his myopia statistics with the incidence of tubercle in his district. There is at least a suggestion pointing toward parallelism between myopia and a tendency to "strumous" affections.

Of 3249 children examined from 1914 to 1917, 612 were myopic or had myopic astigmatism in one or both eyes, urban cases showing a percentage of 17.6, and rural cases 24.2 per cent.

An interesting observation is the preponderance of convergent over divergent squint in these cases—45 of the former as against 29 of the latter. The author does not present statistics bearing on treatment.

Changes in Astigmatia. Jackson⁴³ began the study of changes in astigmatia while practicing in Philadelphia as early as 1890. He has now

⁴¹ American Journal of Ophthalmology, August 1919, p. 606.

⁴² British Journal of Ophthalmology, July, 1919, p. 303.

⁴³ American Journal of Ophthalmology, January, 1919, p. 21.

followed in Denver a new series of cases of operation or injury, keratoconus or disease.

In all of the groups studied, it was found that the tendency is for astigmatism to increase with the rule by increase of the corneal astigmatism, and to increase against the rule by increase of the supplementary astigmatism, which is the difference between the total and corneal astigmatism.

Jackson's conclusions are: Astigmatism is liable to change at any period of life, in childhood frequently because of the increased asymmetry of the anterior surface of the cornea, which is usually in the direction of greater curvature in the vertical meridian, but this change may occur at any time of life: and also in childhood there may be change in the other dioptric surfaces of the eye. "And changes due to this cause become more and more frequent as time goes on. 'Astigmatism with the rule' becomes the exception in the latter part of life, its opposite being now the rule."

Jackson then suggests a more appropriate terminology as "Direct, with the meridian of greatest curvature approximately horizontal," and oblique with the axis between 30 and 60 or between 120 and 150.

Homonymous Hemianopia Occurring in a Case of Malignant Malaria. Weakley⁴⁴ reported the case of a lieutenant, aged twenty-eight years, who came with the complaint that his vision "was shut in at the sides" following an attack of malaria which had then lasted about three weeks during which time the patient had received intramuscular injections of quinine bihydrochloride, gr. x, and also quinine by mouth, gr. x, t. i. d. Blood examination showed at that time the parasites of malignant malaria, but the patient was now free of fever. His memory was very poor and he had a heavy aching across the brows and at the back as if something were tied tightly around his head. Urine was normal, Wassermann negative, no malarial parasites in the blood but a marked excess of mononuclear leukocytes.

There was a patchy anesthesia of the face, mostly on the left side, and tremor of the hands; the cranial nerves seemed intact, knee-jerks normal, Babinski negative and no Kernig's sign. There was also a marked defective sense of orientation in localizing the position of hand and foot of the right side.

Ocular examination revealed: Pupils round and react not very promptly, R. E., $V = 6/24$; L. E., $V = 6/36$. Ocular fundi healthy, vessels and disks normal. Fields yield a right homonymous hemianopia absolute and complete for colors and white. No P. L. in the blind areas.

A lesion of the brain near the angular and supramarginal gyri and the posterior part of the internal capsule (optic radiations) on the left side, caused probably by a vascular lesion (sudden onset) with a blockage by malarial parasites would explain, in his opinion, the four cardinal points of the case *viz.*: (1) Complete right homonymous hemianopsia. (2) Diminution of central vision. (3) Disturbance of peripheral sensation. (4) The loss of sense of localization of the limbs of the right side of the body.

⁴⁴ British Journal of Ophthalmology, July, 1919, p. 300.

RETINA AND OPTIC NERVE.

Detachment of the Retina in Eclampsia and Toxemia of Pregnancy. Medical students are taught the importance of attaining some skill in ophthalmoscopic examinations. Few of them consider the subject of sufficient importance to continue their training after graduation and as a consequence unless patients complain of difficult vision, the condition of their eyes is never known.

Albuminuric retinitis with, or without, papilledema is comparatively common in pregnancy, but reports of detachment of the retina are rare.

Clapp⁴⁵ reports 6 cases, twelve eyes, seen by him in maternity hospitals in sixteen months, in all of which the retina became re-attached antepartum or postpartum. It is easy to associate retinal edema with the cerebral edema of toxemic cases and also to conceive a detachment caused by an edema.

It would seem advisable to concur in Clapp's injunction to examine the eyes of every pregnant woman who complains of failing vision, because he states that the eye should be examined with dilated pupil, since the lesion is often found in the periphery of the fundus, and therefore such a lesion, if small, might cause very little disturbance in vision; therefore the eyes of every pregnant woman should be kept under observation. He advocates eliminative treatment, and considers premature delivery justified when neuroretinitis is found.

DETACHMENT OF THE RETINA CURED BY PUNCTURE AND SUBCONJUNCTIVAL INJECTIONS. Darier⁴⁶ treated in August with success a myope with recent detachment, by means of puncture and injections of acinated serum gelatin, with rest in bed. There was retinal tear. Naturally, the reattachment has not been proved permanent in so short a time.

In early mild cases, Darier's treatment is rest in bed, light pressure bandage, leeches in case of hemorrhage, pilocarpine or eserine and dionin. After five or six days subconjunctival injections of sodium chloride 2 per cent., 4 per cent., even 10 per cent. to 20 per cent. In more serious myopic cases, he adds retinal punctures, and also diaphoresis. A positive Wassermann indicates general treatment and subconjunctival injection of 1 c.c. of:

Cocain hydrochlorid	0.5 gm.
Mercury cyanide	0.05 "
Sodium chloride	2.00 "
Aq. dest.	100.00 mils.

Embolism of the Central Retinal Artery. According to Strebel⁴⁷ only 15 cases of embolism of the arteria centralis retinæ have been cured.

In Strebel's 3 cases, obliterating arteritis seemed the cause in two, and therefore there was nothing to be done; but the third patient had a

⁴⁵ American Journal of Ophthalmology, July, 1919, p. 474.
⁴⁶ La Clin. Ophth., January, 1919, p. 10.
⁴⁷ Correspondenz-Blatt f. Schweizer Aerzte, October 2, 1919, p. 1502. Abstract, Journal of the American Medical Association, November 29, 1919, p. 1731.

cardiac defect and the embolus suddenly caused blindness. The anterior chamber was punctured, the eye massaged, and in less than a month the scotoma had disappeared and the field was normal.

Hereditary Glioma of the Retina. H. M. Traquair⁴⁸ raises the question whether, if records of glioma were investigated from the standpoint of heredity, more cases would not be found in which members of the same family have glioma in view of the 8 cases on record and the fact that the beginning of the disease is usually in intra-uterine life and in several instances of apparent hereditary glioma stillbirths have occurred.

Traquair reports the case of a father whose eye had been removed by Argyll-Robertson for a tumor when six months old. He was married in 1912 and his first child was a stillbirth "six weeks overdue," 1913.

The second child, a male, in 1914, had something wrong with the right eye when six weeks old and at eight months the eye was removed. In June, 1916, the left eye was affected and the orbit exenterated in 1917, the patient dying from general metastasis in 1918.

The third child, female, 1916, showed something wrong in the left eye at six weeks. Glioma was diagnosed, operation refused, and the child died from broncho-pneumonia soon afterward.

TREATMENT OF RETINAL GLIOMA WITH RADIUM. About 20 per cent. of gliomata of the eye are bilateral. Maghy⁴⁹ reports a case in which the second eye was enucleated eighteen years after the first. Any remedy which will give the remaining eye a chance for retention of vision without further jeopardizing the life of the child should receive consideration.

Schoenberg⁵⁰ refers to a case published by Axenfeld⁵¹ of a rather favorable result from the use of x-rays and mesothorium in the case of glioma in a baby, aged eight months, which encouraged him to try the same method in the remaining eye of a child, aged five years, whose other eye had been enucleated. The tumor occupied a little more than a quadrant of the fundus.

On April 10, 1916, radium was applied, 36 millicuries with lead filter, for four hours to the temple: On September 22, 1916, 58 millicuries "filtered through a 4 sq. lead plaque, held over the eye at a distance 1 cm. for eight hours." On June 7, 1918, 20 millicuries over the right side of the orbit through a 2 mm. lead and 1½ mm. silver plaque for fourteen and a half hours. In June, 1919, all that seemed left of the "Glioma" was a degenerated mass and the child seemed healthy.

Kusama⁵² treated 3 cases of retinal glioma with x-rays and radium, checking the ocular growth, with shrinking of the globe. However, metastases caused death in each case.

Retinitis Pigmentosa an Abiotrophy. For many years retinitis pigmentosa has been supposed to be due to hereditary sclerosis of choroidal vessels.

⁴⁸ British Journal of Ophthalmology, January, 1919, No. 1, vol. iii, p. 20.

⁴⁹ Ibid., August, 1919, p. 337.

⁵⁰ Archiv of Ophthalmology, September, 1919, p. 484.

⁵¹ Klin. Monatsbl. f. Augenh., 1914 and 1915.

⁵² American Journal of Ophthalmology, September, 1919, p. 636.

Treacher Collins⁵³ has examined several eyes with this disease, which exhibited no sclerosis of the choroidal vessels, but seemed to show that the primary change was a degeneration of the rods and cones constituting what might be called an abiotrophy, its progress explained as follows: The increase in the neuralgia is like that in neuronc abiotrophy, which does not result in the increased firmness in consistence of sclerosis. The degeneration of the rods and cones with their nuclei leaves spaces in the membrana limitans externa through which the pigment cells or granules can migrate perhaps through their physiological tendency to migrate toward light. The light colored dots in the retina, sometimes on the optic disk, are hyaline degenerated cells of the pigmented epithelium overlying the choroid. The sight begins to fail in a ring scotoma because the neuro-epithelium around the macula is last developed and therefore last involved. The night-blindness is due to failure of vision in the zone 10° to 20° from the fovea, which is the most sensitive to light. Deafness and other nervous manifestations may also be considered an abiotrophy.

Retinal Tuberculosis. According to Jackson and Finnoff.⁵⁴ The commencement of retinal tuberculosis is indicated by white infiltrates in front of retinal vessels, usually the veins, which later "show all of the signs of perivasculitis." Hemorrhages then occur and these may be the first cause of impairment of vision, which impels the patient to seek relief. These may be small and clear up with restoration of vision; or massive—even bursting into the vitreous and resulting in retinitis proliferans.

Sometimes white dots like those in renal retinitis are seen in the macula, causing some impairment of vision and finally disappearing.

"The course of retinal tuberculosis is more protracted than that of other diseases likely to cause some of the same ophthalmoscopic symptoms."

Simple uncomplicated cases do well on small doses of tuberculin at least once a week with the general regimen.

The authors reported three most interesting cases with typically beautiful illustrations.

Buck's⁵⁵ study of the literature and observation of cases indicate that in recurring retinal hemorrhages, especially in the young, tuberculosis of the vessels must be considered a probable cause. "The beginning process is a perivasculitis along the course of the veins, which microscopically shows a round, giant-, and epithelial-, cell infiltration." Subhyaloid hemorrhages, or hemorrhages into the vitreous, may later take place.

Prognosis is unfavorable and detachment of the retina from contraction of fibrous bands may occur.

Senile Macular Degeneration and Senile Opacity of the Lens. Von der Hoeve⁵⁶ writes that, according to his observations, (1) senile macular

⁵³ Ophthalmological Society of the United Kingdom, 1919. Report of American Journal of Ophthalmology, June, 1919, p. 431.

⁵⁴ Transactions of American Ophthalmological Society, 1919.

⁵⁵ American Journal of Ophthalmology, October, 1919, p. 731.

⁵⁶ Archiv f. Ophthalmol., 1918, xlviii, p. 1.

degeneration is very common in the aged; (2) senile lens changes and macular degeneration occur, relatively rare together, each disorder protecting the eye to a certain extent against the other, which theory would be difficult to prove.

The Condition of the Dark-adaptation in Diseases of the Optic Pathway. Igersheiner⁵⁷ states that dark adaptation disturbances occur but rarely in individuals with normal visual and pupillary structures. In general, the reduction of the dark adaptation can be considered as a pathological sign. One dare only quite in a general way assert that disturbances in nerve-condition must be present to evoke it. The dark-adaptation lowering can be accomplished by other important functional disturbances of the optic pathway, but can also be normal in spite of a high grade amount of vision and visual field disturbances.

The author does not consider that the dark-adaptation is of great differential diagnostic significance as does Behr. In choked disk is it mostly normal. In inflammatory processes of the optic nerve, normal as well as pathological values were established, as was also the case in atrophic conditions of the nerve.

In injuries of the occipital region the dark-adaptation was found reduced several times.

Two Cases of Pseudonephritic Neuroretinitis. Neubiner⁵⁸ draws the following conclusions: The star figure in the retinal center is an uncharacteristic symptom; it is mostly the resulting picture from a quickly passing circulatory disturbance in the optic nerve trunk or in the neighboring retina. According to this it is not necessary that an inflammation precede. With the exception of other occasional causes, emboli originating as a result of inflammatory processes in the optic nerve trunk or its coverings appear etiologically important.

Night-blindness as a Result of Gassing. Jess⁵⁹ reports 4 such cases and thinks that these disturbances of adaptation should be considered in 3 of them as the result of local retinitic or neuroretinitic changes.

To this assumption point the slight definite fundus changes in the retinal periphery, and at the emergence place of the vessels.

Intracranial Sarcoma, with Early Symptoms of Acute Retrobulbar Neuritis. McNabb⁶⁰ reported the case of a sixteen-year-old boy, whose vision L. E. had been blurred for one week, with periorbital aching, pain on movement of the eye or when it was pushed backward. R. E. V. 5/4; L. E. V. Fingers. Fundi normal.

Acute retrobulbar neuritis was diagnosed. In seven days paresis of the sixth nerve appeared. In nine days, L. E. V. no L. P., slight blurring of disk, no injection of eye, movements limited, normal temperature. The patient could not smell with the left nostril. Left nasal cavity normal. Other cranial nerves normal. No pulsation, no bruit; nothing felt in left orbit; x-ray showed abscess of left frontal sinus. In sixteen days, August 19, there was marked proptosis of the left eye, conjunctival

⁵⁷ *Archiv. f. Ophthalmol.*, 1918, xcvi, p. 67.

⁵⁸ *Klin. Monatsbl. f. Augenheilk.*, 1919, p. 780.

⁵⁹ *Ibid.*, March-April, 1919, p. 400.

⁶⁰ *British Journal of Ophthalmology*, January, 1919, No. 1, iii, p. 16.

chemosis, pupil widely dilated and fixed, movement very limited. R. E. V. 5/20 and fundus normal. On the next day, the region of the left frontal sinus was explored, but no evidence of growth or sinus was found. The eye was enucleated and the orbit found free of growth. August 20, R. E. V. hand movements on nasal side only. Disk blurred. Autopsy in three weeks revealed a flat dural growth from the sella on the left side, spreading to the middle fossa, and over the small wing of the sphenoid to the right side. A small periosteal sarcoma.

McNabb does not indicate that fields were taken at any time.

X-ray of Sella Turcica in Hereditary Optic Atrophy (Leber's Disease). Recently a member of a family examined by Gordon Holmes and James Taylor⁴¹ years ago, presented himself to the latter with this disease at the age of fifty-two with the history that his vision had suddenly altered in October, 1917. The x-ray revealed that the sella turcica was long and shallow and the clinoid processes not normal. Another brother examined years ago by them was again examined and found to have a similar and more marked change in the sella.

In 1907, Nettleship⁴² called attention to "Central amblyopia as a symptom in tumor of the chiasma," and Taylor calls attention to Fisher's remark that a loss of temporal field in chiasmal cases frequently starts as a central expanding scotoma.

In the *Ophthalmoscope* for August, 1916, J. Herbert Fisher suggested that the occasional presence of vertigo, headache, and epilepsy, also the fact that subjective phenomena of light and color have been noticed in familial optic atrophy and in pituitary disease, point to the latter as a causative factor, supported by the fact that the onset of Leber's disease occurs at the sexual developmental period or at the beginning of its decline and he called attention to the frequent sexual disturbances in pituitary disease.

In the transactions of the American Ophthalmological Society of 1918, Zentmayer presented x-ray pictures of the sella in two families with Leber's disease and concluded that the uniformity of his findings suggested the very interesting possibility, that Leber's disease might be connected with discrepancies in the size of the pituitary fossa although unwilling to positively maintain that connection.

Both these authors agree that much more work will have to be done before proof is established but the sella findings are certainly suggestive.

Acute Retrobulbar Neuritis Accompanying Ophthalmic Herpes Zoster. Veasey⁴³ reports herpes zoster ophthalmicus accompanied by acute retrobulbar neuritis, which was seen by him in 1911 in an intelligent woman who had noticed increasing central scotoma with no ophthalmic change in fundus or nerve. The eye was congested, with lacrimation, but at no time was the cornea involved, nor the nasal branch of the fifth nerve.

Since retrobulbar neuritis may be caused by focal infection, and herpes zoster has also been attributed to the same cause, Veasey is in doubt

⁴¹ British Journal of Ophthalmology, vol. iii, 193.

⁴² Transactions of the Ophthalmological Society of the United Kingdom, xvii, 277.

⁴³ Transactions of the American Ophthalmological Society, 1919.

whether the same factor entered into both conditions or whether the optic neuritis was due primarily to the herpes.

Veasey also reports an attack of acute glaucoma, in a man, aged thirty years, three weeks after an attack of herpes zoster affecting the supra-orbital and nasal branches. Intra-ocular pressure was 35 mm. and became normal under pilocarpine, hot compresses and purging.

In the discussion, Knapp suggested a lesion of the ciliary ganglion and mentioned a case in which the cause of the hypertension (50 to 60 mm.) seemed to be a cyclitis, since corneal deposits were present. The tension was reduced by pilocarpine, and six months later a mydriatic was given for a corneal ulcer without causing glaucoma.

De Schweinitz had seen several cases, two of which were also cyclitic in origin. Verhoeff had seen a case of herpes zoster with a slight iridocyclitis, which cleared up leaving a typical unilateral Argyll-Robertson pupil, which tends to confirm the theory that a lesion of the ciliary ganglion can cause an Argyll-Robertson pupil.

Other cases were reported by Greenwood, Clark, Lamb, Parker and Woods.

The Eye and Accessory Sinus Disease. Vail⁶⁴ reports 3 cases of "MONOCULAR RETROBULBAR NEURITIS FROM HYPERPLASIA OF THE ETHMOID," which were cured by operation.

The positive findings of this condition are: Monocular blindness, with a large central scotoma, a sluggish direct pupillary reaction, and pain on deep pressure. The negative findings are a normal disk and fundus and a normal turbinate, due to the narrowness of its isthmus of connection with the ethmoid. Later atrophy may appear in the disk. The frequency of the disease is explained by the "aberrant anatomical arrangement of the posterior ethmoid cells, in relation to the optic nerve in affected cases and not in others." As in the sphenoid, the optic nerve may lie within the posterior ethmoidal cell.

Langdon⁶⁵ published a somewhat similar case except that it was attributed to a sphenoiditis.

BITEMPORAL HEMIANOPSIA DUE TO ACUTE SUPPURATION OF THE NASAL SINUSES is so rare that only 4 cases had been reported before that of Conlon⁶⁶ whose patient before operation had in one eye vision of 6/6, with a fuzzy disk and engorged vessels, and in the other vision of 6/200, with an absolute central scotoma and 2D of swelling in a blurred disk. Suction revealed pus daily. After a submucous resection and an exenteration of the posterior ethmoids and sphenoids, vision improved and a typical bitemporal hemianopsia was discovered. A month after the operation the fields were normal except for an enlarged blind spot.

While the nasal fibers of the optic nerve are in contact with the lateral wall of the sphenoid, and while a single sphenoid may contain both nerves,⁶⁷ a *bitemporal hemianopsia such as this can only be explained* by supposing a close contact of the chiasm with the sphenoidal sinus,

⁶⁴ Transactions of the American Ophthalmological Society, February, 1919, p. 96.

⁶⁵ Ibid., September, 1919, p. 697.

⁶⁶ Ibid., February, 1919, p. 92.

⁶⁷ Onodi: Arch. f. Laryng. Rhinol., 1903, xiv, p. 360.

which, though rare, has been demonstrated by one of Onodi's plates and also by Loeb.⁶⁸

Magruder⁶⁹ added a case of iritis from antrum infection.

Ocular Disturbances in Mastoiditis. Dittman⁷⁰ has had 2 cases of abducens paralysis, which recovered, one after mastoidectomy, and the other under injection of 2 minims of phenol neutralized with gum camphor into the middle ear every other day. He suggests an anomaly of the relation of the sixth nerve to the petrous portion of the temporal bone.

Frias Onate⁷¹ counsels frequent examination of the eyes with the ophthalmoscope in mastoiditis because hyperemia of the optic papilla is frequently one of the first signs of cerebral complication and therefore is an indication for immediate operation.

Narrow and Spiral Fields of Vision in Hysteria, Malingering and Neurasthenia. Hurst and Symms⁷² believe that narrowing of the fields is not a stigma of hysteria, but rather that it is suggested to the patient by the use of the perimeter, because they have never seen hysterical patients who complained of disabilities caused by tubular vision until after the narrowing of the fields is produced by the examination. After the latter occurrence, if the examination was continued, a spiral field was always obtained, which is the "natural result of continued suggestion"—an inward spiral, produced by the usual method of examination, *i. e.*, moving the disk from without inward; and an outward spiral if the disk is moved from the center outward.

Nevertheless while contraction of the fields is not now considered *per se* a stigma of hysteria the very fact that it can be suggested indicates that one has to deal with an "abnormal nervous mechanism" as de Schweinitz⁷³ aptly says.

GLAUCOMA.

Tonometry. According to McLean,⁷⁴ the disadvantages of previous existing tonometers are: The distance between the reading scale and the foot plate; the readings are on an arbitrary scale and must be translated by a rather difficult chart; the trouble in changing weights; and the fact that accuracy is impaired by capillary attraction with the plungers now used.

The accuracy of his own instrument has been controlled through experiments on enucleated human eyes by a special water manometer. Having connected the interior of the living human eye to the manometer and having found that his tests usually agreed with those on the same eye after enucleation, he believes that his tonometer is fairly accurate. He found that the Schiøtz instrument records the intra-ocular

⁶⁸ Operative Surgery of the Nose, Throat and Ear, 1917, i, p. 481.

⁶⁹ American Journal of Ophthalmology, May, 1919, p. 347.

⁷⁰ Journal of the American Medical Association, November 15, 1919, p. 1550.

⁷¹ Vida Nueva Havana, August, 1919, p. 172; Journal of the American Medical Association, November 15, 1919, p. 1563.

⁷² British Journal of Ophthalmology, January 19, No. 3, iii, p. 17.

⁷³ Transactions of the American Ophthalmological Society, 1919.

⁷⁴ Archives of Ophthalmology, January, 1919, No. 1, vol. xlviii.

pressure too low. Also that ether anesthesia produces a marked fall both with the tonometer and manometer.

Treatment of Glaucoma." In a paper on the treatment of glaucoma, Weeks⁷⁵ states that in at least 90 per cent. of all patients with idiopathic glaucoma, infantile glaucoma excepted, there is a history of chronic constipation, the correction of which goes far to relieve hypertension.

In addition to the local use of pilocarpine and eserine, he gives jaborandi internally, opium at times, and induces free catharsis.

He has not found any advantage in combining dionin with miotics. Reference is made to the value of employing miotics as a preventive, as well as a corrective, measure.

In all cases where tension is above 25 (Schiötz) miotics are resorted to in an endeavor to hold it at or below that degree. Fields of vision for form and color are taken from time to time, and the degree of vision determined.

The treatment with miotics has been very satisfactory in the great majority of cases of idiopathic glaucoma, and even in hypertension following cataract or other operation on the eye permanent relief is obtained in a high percentage of cases. If eserin (the salicylate of which is used as a rule) in 0.5 per cent. solution, used three times in the twenty-four hours, does not suffice to hold tension at, or below, 25, the author insists upon operation with very few exceptions.

In secondary glaucoma the effect of miotics is not so marked, and in most cases if tension is above 35 they do not appear to be of much value.

A diminution in the field of vision for form and colors, with or without enlargement of the blind spot, is an urgent sign showing the necessity of operation, as is also a slight positive diminution of central vision.

Operation is advised also when the patient is inclined to be irregular in the use of miotics, and in cases of contemplated long absence from efficient observation by an ophthalmologist.

As to operation to be employed, this must be determined by the characteristics of the individual case.

In buphthalmos, paracentesis at the corneoscleral limbus may be resorted to in the early stage, the opening being made patent every five to eight days for as many times as is required. When the patient has reached the age of four to eight years, trephining is the operation of choice.

In subacute and simple glaucoma, the author prefers the Lagrange operation for the securing of a filtering cicatrix, limiting the use of the trephine to buphthalmos, some cases of deep anterior chamber, and to cases of chronic simple glaucoma with relative low tension.

Congestive Glaucoma after Homatropin and Eserin. Too great care cannot be taken to follow up middle-aged cases in which a cycloplegic has been used for purposes of determining refraction, or a mydriatic for ophthalmoscopic examination. The most normal appearing eyes may have a beginning glaucoma, which may destroy sight before the patient can obtain relief.

⁷⁵ Journal of the American Medical Association, October 11, 1919.

Desai⁷⁶ reports a case of a woman, aged forty-eight years, who came to have her eyes tested. The tension was normal with the fingers, and the pupil reaction good. After instillation of homatropin, 1 per cent., the refraction was found to be plus 4.5D each eye and V = 6/6 each. Eserine was used before the patient departed. In three days she returned with the history of severe pain and loss of sight in the right eye from the day after examination (showing in the author's opinion that the effect of the mydriatic lasted longer than that of the eserine) and the patient presented all of the symptoms of congestive glaucoma, *viz.*, dilated, immobile, pupil, very shallow anterior chamber, and steamy cornea with tension of 45 mm. V = light perception. No view of fundus. Neither miotics nor an iridectomy brought relief, which was only accomplished by an Elliott sclerocorneal trephine.

TOXEMIA AND EYE-DISEASE.

Toxemia from by-products of proteid digestion received deserved attention for years, then interest in focal infections from the teeth, tonsils and sinuses seemed to supplant that in ocular disease from intestinal toxemias; but only lately have ophthalmologists seemed again to awaken to the baneful possibilities of overindulgence in sugar by patients suffering from certain eye-conditions.

Before operating upon the eye, Bell⁷⁷ refers suspected cases to a dentist, then after the mouth is in order, he waits several weeks for the elimination of toxins.

In addition to the usual ocular diseases due to infection from the tonsils he added a case of obstinate conjunctivitis with refraction corrected properly, which had been treated for several years without result until the tonsils were removed, when recovery followed in six months.

As one of the causes of intestinal toxemia, Bell lays stress upon overindulgence in sugars. Before the war, about 90 pounds of sugar represented the per capita consumption in England and the United States. The factors necessary for sugar fermentation are free undigested sugar in the stomach or intestines and a sufficient quantity of bacteria to attack it. Fermentation generally produces hyperacidity or a tendency to acid stools.

In addition to cyclitis, Bell believes many cases of phlyctenular disease attributable to too much sugar, and finally reported a case of retrobulbar neuritis in a woman, aged twenty-seven years, whose vision was reduced to 20/200 in each eye. The patient ate one-half pound of candy and three ice cream sodas daily. She was given a dose of castor oil, and a diet free of sweets was prescribed with one bottle of Bulgarian bacilli before meals. In two months vision was normal.

Schoenberg⁷⁸ contributed another case of retrobulbar neuritis in a child with intestinal stasis, which recovered during the treatment of the toxemia.

⁷⁶ British Journal of Ophthalmology, June, 1919, No. 6, iii.

⁷⁷ Transactions of Ophthalmological Section of the American Medical Association, 1919, p. 266.

⁷⁸ Archives of Ophthalmology, January, 1919.

Knapp reported 3 such cases of sympathetic ophthalmia in two of which the patient consumed large quantities of sugar and improved on a sugar-free diet, while the third had a toxic, acid stool with excess of indol and skatol and, as in his case No. 3, Gram-positive bacteria. The vision was also restored while under general diet and treatment.

Ocular Complications of Influenza. In about 1898, the editor had a case of glaucoma coincident with "Grippe," which was treated as "Pink Eye" for a week by the family physician, as a consequence of which the patient was blind when he came to the clinic.

Orcutt⁷⁹ brought up the subject of glaucoma as the result of influenza, before the Chicago Ophthalmological Society, April 21, 1919. In the seven months ending in March, 1919, 60 per cent. of glaucomas in the Illinois Charitable Eye and Ear Infirmary were acute: In 1917-18, 20 per cent.; in 1915-16, 14 per cent. were acute. Eight of the 13 cases of acute glaucoma gave a history of Spanish influenza before the attack. Any circulatory or inflammatory disturbance in a person with beginning glaucoma might excite an acute attack.

Green and Green⁸⁰ report an attack of acute glaucoma coincident with influenza in a woman, aged thirty-three years, which later recovered vision under miotics in one eye, and operation of the other. Also a case of acute glaucoma in one eye, in a woman, aged twenty-eight years, which recovered under miotics.

They also reported a case of unilateral metastatic ophthalmitis resulting in pseudoglioma in a child, aged three years, who had influenza and pneumonia for a week before the eye became blind; also an iridocyclitis following a needling of a congenital cataract in a child, aged five years, after the eye had been quiet for a week, which well might have occurred without the intervention of influenza: Also 1 case of blurred disk, retinal hemorrhages, arterioles tortuous, with yellow pin-point spots about the macula, concerning which a report on the urine, etc., would have been more convincing, as is also true of the case of hemorrhage into the vitreous in a man, aged thirty-eight years. Their case No. 7, was a paresis of accommodation appearing in both eyes in a girl, aged twenty-one years.

Paresis of the external rectus has been fairly frequent, Zentmayer⁸¹ reporting 3 cases, while Schumway had seen 6 cases of ocular palsy, of the abducens and oculomotor with the facial involved twice. Since there was a history of influenza in only 1 case he was inclined to attribute them to another infection, perhaps lethargic encephalitis, the connection of which with influenza has not been settled.

Zimmermann⁸² states that an optic neuritis of infectious origin occurs more frequently in influenza than in any other infection. In Uthoff's service since 1900, among 253 cases of optic neuritis in infectious disorders, influenza was the cause in 28 per cent., syphilis, acquired and hereditary, in 24 per cent., rheumatism in 14 per cent., malaria-typhoid

⁷⁹ American Journal of Ophthalmology, July, 1919, p. 533.

⁸⁰ Ibid., August, 1919, p. 607.

⁸¹ Ibid., p. 611.

⁸² Klin. Monatsbl. f. Augenheilk., 1919, p. 213.

in 6.7 per cent., and the remainder were distributed among 12 different infections.

There were isolated cases in which a polyneuritis was present at the same time as an optic neuritis as a result of influenza.

There were noted in the last epidemic several cases of paresis of accommodation due directly to the influenza-virus.

The most infrequent ocular complication of influenza is possibly disturbance of convergence.

Ocular Symptoms of Lethargic Encephalitis. Cases of lethargic encephalitis were reported in this country by Bassoe,⁸³ Ely,⁸⁴ and Tucker.⁸⁵

Woods⁸⁶ has studied the ocular manifestations of this disease in 7 cases. Of these, 2 had had influenza, 1 was doubtful, and 4 gave no history of this disease.

Optic neuritis was present in only 1 case. Serious impairment of accommodation, with varying reactions of the pupils, was present in 3 cases, while a fourth case, too young for tests of accommodation, exhibited similar pupillary conditions.

In 1 of the 4, other branches of the third were affected; in 2 there was abducens paralysis, and in 3, facial paralysis. Return to normal of the intrinsic muscles was slower than that of the extrinsic. Nystagmoid movements occurred in 5 cases.

In explaining the variety of clinical manifestations, Woods inclines to the belief of Melland⁸⁷ that they depend upon whether the disease is an encephalitis inferior or superior, the former accounting for the muscular symptoms. Since the disease is a perivascular infiltration, the clinical symptoms will vary with the site.

The low grade of inflammation about the brain stem will cut off afferent impulses to the cerebrum to such a degree as to cause stupor. "The ocular symptoms have a definite tendency toward spontaneous recovery."

Sympathetic Ophthalmia and Possibly Related Processes in Other Parts of the Body. Since a uveitis, closely resembling sympathetic ophthalmia clinically, may be caused by a focal infection from teeth, tonsils, sinuses, prostate, etc., it is probable that many cases of such uveitis following an injury of one eye have been erroneously diagnosed as sympathetic ophthalmia, not cured by enucleation of the injured eye, but which might have been relieved by finding and removing the focus of infection.

Harbridge⁸⁸ suggests this theory from an experience of 400 injured eyes, in which no case of sympathetic ophthalmia occurred, though a foreign body remained in the globe in a certain percentage of patients. He considers the decreasing number of sympathetic ophthalmias, in spite of the increasing number of injuries, an argument against the theory of anaphylaxis from injured uveal tissue.

⁸³ Journal of the American Medical Association, 1919, p. 677.

⁸⁴ Ibid., April, 1919, p. 985.

⁸⁵ Ibid., May, 1919, p. 1448.

⁸⁶ American Ophthalmological Society, 1919, reported in Archives of Ophthalmology, November, 1919, p. 536.

⁸⁷ British Medical Journal, 1918, p. 539.

⁸⁸ American Journal of Ophthalmology, April, 1919, p. 269; Thesis, American Ophthalmological Society, 1919.

OCULAR THERAPEUTICS.

A Case of Poisoning by Homatropin. The patient was a child, aged five and a half years, who had had atropine used by Craig⁸⁹ two years before, gr. iv to 5j, twice daily for three days without unpleasant symptoms.

On the present occasion homatropin, gr. iv-5j, was dropped into each eye and the child sent out with its mother for a visit to friends in the neighborhood. Upon its return two hours later, there was present intense mental excitement, laughing, talking incoherently and hallucinations of vision, also dryness of the mouth. This condition lasted until three o'clock the following morning when she fell asleep. On being awakened, five or six hours later, she was normal.

The same solution has been used a number of times since with no unusual general effects on the part of the patient. In one or two there has been a slight sensation of giddiness with dryness of the throat, which suggests that impurity of the drug accounts for the symptoms.

Ocular Lesions Following Antityphoid Vaccine. For several years cases have been reported of *keratitis herpetica febrilis consecutiva to antityphoid vaccination*, the French especially observing a large number, and even 1 case of acute bilateral iridocyclitis followed later by corneal herpes, published by Prelat.⁹⁰

Luna⁹¹ reports the case of a man who had had, three years previously, an attack of herpes corneæ following catarrh of the upper air passages, which resulted in denticular keratitis, and which recovered leaving a thin, superficial opacity. The third injection of 1 c.c. of Mulford's "Typhobacterin Mixed" was given at 6 P.M.; from midnight there were fever (39.6° C.) and headaches lasting through the next day when the temperature fell and nasolabial herpes appeared. The following morning the eye was inflamed, and when seen, five days later, presented two central, branching superficial corneal ulcers.

Since these cases are the exception after vaccination, Luna feels that a predisposing cause must exist in order that vaccine may cause an ocular lesion.

However, the fact that herpes is so rare after vaccination is not a valid argument against its dependence upon vaccination any more than the fact that malarial keratitis is so rare in the great number of malarial patients; and it can be explained by supposing a special affinity of the corneal nerves for the toxin in a few individuals.

Bell⁹² reports a case of keratitis profunda following the second injection, in which syphilis, tuberculosis, the teeth and tonsils were eliminated as factors.

Calhoun⁹³ records 5 cases of uveal inflammations following the first or second inoculation.

Lancaster had seen a number of cases of neuropathic keratitis.

⁸⁹ British Journal of Ophthalmology, June, 1919, No. 6, iii, p. 250.

⁹⁰ Arch. d'Oph., November, 1917.

⁹¹ American Journal of Ophthalmology, July, 1919, p. 488.

⁹² Archives of Ophthalmology, May, 1919, p. 273.

⁹³ Transactions of the American Ophthalmological Society.

Non-specific Protein Therapy in Diseases of the Eye. William Boyd⁹⁴ remarks upon the emphasis which was placed upon specificity in vaccine treatment by the followers of Wright and the fact that the pendulum is now swinging, perhaps too much, in the direction of uncontrolled foreign proteid injection for many infections for which a specific vaccine has not been discovered. In his own work, the most suitable cases are those "in which there is a chronic intoxication from some focus which cannot be located or removed," such as arthritis, myositis neuritis or iritis. His principal successes seem to be in the use of INTRAVENOUS INJECTIONS OF TYPHOID BACILLI. A young physician with chronic iritis in both eyes and periodic relapses came to him in 1916. Wassermann and tuberculin tests, teeth, throat, nasal sinuses and prostate were all negative. An injection of 25 million typhoid bacilli aborted an attack. A series of five injections resulted in a cure which has continued for three years.

PARENTERAL INJECTIONS OF MILK formed one of the two most discussed subjects before the Swiss Ophthalmological Congress of 1919.

Darier⁹⁵ treated 5 cases of parenchymatous keratitis, of whom 4 gave a positive Bordet-Wassermann. In one, the milk gave a favorable result at the moment when intravenous injections of mercury cyanide appeared to have no effect. He has not obtained the rapid cessation of photophobia and blepharospasm which he had observed after antidiphtheritic serum. He believes that injections of milk are a stimulant to the general defense of the organism by activation of leukopoiesis and phagocytosis as well as by provoking a transient febrile state (Pyretotherapy). Combined with serotherapy by the mouth, it constitutes a certain means of combating various infections, especially ulcers, iritis, and traumatic and postoperative infection. He advocates 10 c.c. of serum by mouth in twenty-four hours for several days and 5 c.c. of milk injected every two days, in addition to the local treatment.

The use of antidiphtheritic serum by the mouth does not appeal because digestion eliminates the one factor upon which the use of such sera is founded, *i. e.*, the foreign proteid becomes assimilated and is no longer foreign.

Gaupillat⁹⁶ reports rapid relief from pain after injections of milk in the gluteus. The parenteral injection of any foreign proteid is attended with some danger of misapprehension because there is no way of controlling it, but Key⁹⁷ reported his results from antidiphtheritic serum in 23 cases of hypopyon keratitis, 2 infections of the anterior chamber after penetrating wounds, 4 of panophthalmitis and 1 of ulcer serpens.

Among his conclusions are: "Favorable results with paraspecific therapy are by far in the majority;" antidiphtheritic serum is readily obtained, the dosage more certain and the preparation more dependable than others; it should be administered early; the dosage is 5000 units, infrequently repeated, to 2000 units every day for three or four days;

⁹⁴ Journal of Laboratory and Clinical Medicine, November, 1919, p. 88.

⁹⁵ La Clin. Opt., March, 1919.

⁹⁶ Ibid. February, 1919, p. 73.

⁹⁷ Thesis, American Ophthalmological Society, reported Archives of Ophthalmology, December, 1919, p. 581.

adverse effects seem insignificant; its effect is limited by syphilis untreated or probably other systemic conditions; and "Local measures, as indicated, are essential."

Stoecker⁹⁸ reports 28 cases of inflammations of the conjunctiva, cornea, iris, ciliary-body or choroid treated by injections of cow's milk. Three to 12 gm. of cow's milk after four minutes boiling was injected under the freely movable skin of the abdomen.

In 25 of the 28 cases an improvement occurred following these injections, the pain and inflammation subsiding rapidly.

Musy, at the same meeting, stated that he had employed parenteral injections of milk in 4 cases of rheumatic iritis with a good result.

The milk was not boiled but pasteurized for fifteen minutes in a jet of steam. Injections of 5 c.c. were made deep into the gluteal muscles every two to four days until the result was distinctly visible; as a rule 2 or 3 injections sufficed.

Rapid Cure of a Case of Blennorrhagic Ophthalmia after Injection of Sterilized milk. Nussbaum⁹⁹ reported that three days after entering for urethral blennorrhagia a patient presented a marked swelling with redness of the left conjunctiva; moderate suppuration, gonococci in the pus, cornea clear, iris free from irritation. Lavage with potassium permanganate, salts of silver three times daily. The trouble increased, cornea turbid and its superficial layers softening.

On the sixth day after his entrance, an injection of sterilized milk (10 c.c.) was made in the gluteal region.

Ten days after the injection the corneal epithelium everywhere reestablished itself and cleared from the periphery to the center. The urethral blennorrhagia was not influenced by the injection.

Thyroid Therapy in Ophthalmic Practice. Percy Dunn¹⁰⁰ supplements his article in the *Lancet*, 1916, vol. i ("Some Aspects of the Ciliary Body in Health and Disease"), in which he advocated the use of thyroid in certain infections of the eye. The delicate and vascular ciliary body is exceedingly responsive to a toxic blood supply. Two of the causes of this kind of toxemia are intestinal putrefaction and septic foci, *e. g.*, pyorrhea, in which signs of hypothyroidism are distinctly marked.

The thyroid exercises a "protective, antitoxic and immunizing action, defending the body against invasion by disease-producing organisms."¹⁰¹ Pyorrheal iridocyclitis is caused by a failure of the thyroid to control the toxemia arising from the septic source. This is also true of the iridocyclitis which is known as "Keratitis punctata" and which is generally due to intestinal putrefaction which "postulates thyroid insufficiency" and "calls for thyroid therapy." Since "an ill-functioning thyroid determines the virulence of a toxemia and its effects," Dunn suggests that even in virulent corneal ulcers the prevailing toxemia is insufficiently modified by the thyroid, and believes that interstitial keratitis is more hypothyroidal than syphilitic because "the small

⁹⁸ Society of Swiss Ophthalmologists, 1919.

⁹⁹ *La Clinique Ophthalmologique*, August, 1919, p. 474.

¹⁰⁰ *British Journal of Ophthalmology*, January, 1919, No. 1, iii, p. 10.

¹⁰¹ *The Thyroid Gland in Health and Disease* by Robert McGarrison, 1917, p. 21.

patients are generally abjectly miserable in appearance, thin, dejected, nervous, physically weak, without desire for food, in bad cases intensely photophobic."

Again as in keratitis punctata, a tubercular taint is a factor. Dunn has found thyroid therapy satisfactory in such cases.

At the menopause, Dunn has found cases of asthenopia, which persisted in spite of correction of errors of refraction, relieved by thyroid treatment.

Another sign of thyroid inadequacy is tendency to hemorrhage. In subconjunctival or retinal hemorrhage, this possible factor should not be neglected since patients with manifest hypothyroidism have exhibited such lesions.

Constipation as a factor does not preclude hypothyroidism because it also is often to be attributed to the latter, and in many cases of recurrent hemorrhages, thyroid therapy should be given a trial.

An Unusual Case of Idiosyncrasy to Quinine. Elliot¹⁰² reports the case of a chemist who suffered from headache, deafness, diminution of vision and contraction of fields, a quarter of an hour after small doses of quinine. In reading, letters appeared doubled. Before taking, V. was 6/6 R. and L.; twenty minutes after taking 2 grains of powdered sulphate of quinine R. E. V = 6/12, L. E. V = 6/6. The disks were pale, arteries constricted; the patient read with difficulty. In forty-five minutes, the disks were paler, arteries smaller, and the visual fields markedly reduced. A cup of strong coffee always relieved the patient's symptoms and restored vision. The records show that a decided attack of quinine amblyopia produces undue sensitiveness to the drug.

Traquair¹⁰³ reports one patient who had taken 2 or 3 grains of quinine for three weeks and then 20 grains in one day with prompt loss of vision for a week. Eight months later there was optic atrophy, contraction of fields and impairment of light sense.

His second case had received 120 grains in thirty-six hours; total blindness in a few hours with improvement in eight days. Three months later sight was dim, fields contracted, disks pale, and vessels constricted.

The third case received a total dose of 20 grains in twelve hours and was found to be blind several days later. Two months afterward the disks were pale and the fields contracted; in three months there was constriction of vessels and difficulty in reading.

The large doses taken by the laity in this country for colds and for "Malaria," as well as for the purpose of producing abortion, impels one to imitate Elliot's example in sounding a warning to practitioners to educate the public against the indiscriminate use of quinine, and also in remembering that a patient may have good central vision after quinine poisoning and yet have contracted fields, which at first do not inconvenience the patient, but later may progress to actual incapacity.

Quinine Amblyopia from Rectal Administration. Nagel¹⁰⁴ reported the case of a woman who had been given by her surgeon "for postopera-

¹⁰² British Journal of Ophthalmology, January 19, 1919, No. 1, iii, p. 8.

¹⁰³ Edinburgh Medical Journal, March, 1919, p. 169.

¹⁰⁴ American Journal of Ophthalmology, January, 1919, p. 54.

tive gas pains" 5 grains of quinine in enema every four hours. After 30 grains had been given, the patient had symptoms of failing heart and the order was then changed to every twelve hours. After 60 grains had been given there was a very weak pulse, loss of consciousness and blindness. No eye-examination had been made in the seven months before Nagel saw her.

Iridocyclitis with Ocular Hypertension Reduced by Arsenobenzol. Morax and Fourriere¹⁰⁶ recorded 3 cases of the hypotensive action of salvarsan in secondary glaucoma of syphilitics. One a chronic bilateral glaucoma, one a glaucoma secondary to diffuse choroiditis, the third a double glaucoma secondary to an iridocyclitis.

Piemont¹⁰⁶ writes of a woman whose husband was syphilitic, and whose first two children were born healthy; the third was a miscarriage at seven months. She had exhibited no signs of syphilis except rheumatoid pains in her legs.

There was an iridocyclitis with a triangle of precipitate on the cornea and hypopyon; condylomata in the iris. V = hand movement. T = 50 mm. A series of intravenous injections of Hg Cn caused improvement, and tension became 30 mm. after which it began to increase. An injection of 0.3 arsenobenzol then caused a marked reaction, and when symptoms subsided 0.6 were given twice with marked benefit, and vision was improved. At no time was there increase in general blood-pressure.

Methylene Blue in Purulent Discharge from the Orbit. Although methylene blue had no bactericidal effect upon agar culture of the *Staphylococcus aureus*, which was the prevailing discharge from 9 purulent eye sockets, McIlroy¹⁰⁷ found a 1 in 1000 saline solution of methylene blue very efficacious in the living subject after enucleation of the globe.

Adams¹⁰⁸ seems to have established the success of methylene blue in eye disease caused by *Staphylococcus aureus*.

Colloidal Manganese in Gonorrheal Ophthalmia. Livingstone¹⁰⁹ believes that nitrate of silver is too irritating in the acute stages of this disease, and claims great success from buttock injections of 1 c.c. of colloidal manganese in 3 cases. The result in one severe case in a man aged twenty-four years seemed truly dramatic.

Calomel Ointment in Certain Opacities of the Cornea. Ryerson¹¹⁰ claims improvement in the denser forms of corneal opacity from calomel in vaseline, 3j to 3j, placed daily in the conjunctival sac and smeared rather thickly upon the lids after which a pressure pad and bandage are applied for two hours.

While stimulating ointments, *e. g.*, the yellow oxide, have seemed of value in these cases, it is difficult to understand how the insoluble chloride should be preferred, and especially in opacities in the vitreous which he also cites.

¹⁰⁶ Annal. d'Ocul., 1911.

¹⁰⁶ Annal. d'Ocul., July, 1919, p. 406.

¹⁰⁷ British Medical Journal, April 5, 1919.

¹⁰⁸ Ophthalmoscope, February, 1916, xiv, p. 978.

¹⁰⁹ British Medical Journal, April 5, 1919.

¹¹⁰ Canada Lancet, April, 1919.

The Analgesic Action of the Weak Faradic Current in Ocular Therapeutics. Geos and Fromaget¹¹¹ have been surprised and gratified with this treatment of the pain in iridocyclitis, keratitis, glaucoma, acute conjunctivitis, neuralgia and sciatica. They have found no results in migraine or rheumatic pains.

A large plate of malleable metal, resting upon moist compresses placed on the painful area, is connected to one pole of the secondary coil while the other is held in the hand. The current should not be disagreeably strong. Two or three minutes are sufficient to establish the amenability of the pain to treatment.

Iodine in Ocular Therapeutics. Extreme care in the local application of iodine in eye work has always been counselled because of its unpleasant results on healthy portions of the cornea. In 1905, Chassevant pointed out the great tolerance of the skin and even mucous membranes for iodine in chloroform.

Several years of war corroborated his opinion that this solution does not destroy living cells, but that degenerated cells, pus and microbes are impregnated and eliminated.

Terson¹¹² uses in corneal ulcers a solution of 1 to 30 in a dark bottle with stopper lightly vaselized. Cork is rapidly destroyed and permits evaporation. This non-caustic solution may be applied with a pointed match or small cotton applicator. Severe ulcers touched once daily until they become yellow, heal steadily, without scarring. Terson also advocates its use in recent corneal wounds, filamentous keratitis, herpetodendritic keratitis, etc., also in trachoma, disease of the lacrimal passages, suppurating blepharitis, variola, erysipelas, lid infections of all kinds, malignant pustule, zona, etc.

Tuberculin. Török,¹¹³ of New York, announces the following conclusions in his article on tuberculin in the diagnosis and treatment of eye diseases:

1. The eye condition is considered tubercular only when a positive focal reaction is observed.

2. Where a positive focal reaction is not obtained, but the patient shows a positive general and local reaction, and other possible causes are excluded with reasonable certainty, the case is to be considered of possible tuberculous origin.

3. Tuberculin should always be in a fresh solution, not over two weeks old.

4. For diagnosis in eye conditions only, the subcutaneous injection is of value. It can be used in children as well as adults.

5. Tuberculin is a valuable remedy in ophthalmic therapeutics provided it be used in very small doses—in eye affections where a positive focal reaction is obtained. It is not dangerous under these conditions.

6. Treatment is to be started with a very small dose— $\frac{1}{100000}$ mgm.—increased slowly to the maximum that the patient can tolerate, but in no case to exceed 1 mgm. All reactions are to be avoided.

¹¹¹ *La Clin. Ophth.*, January, 1919.

¹¹² *Annal. d'Oculist*, June, 1919, vol. clv, p. 328.

¹¹³ *Archives Ophthalmology*, May, 1919, vol. lvi, p. 242.

7. Duration of treatment should be long. Relapses are frequent in cases where treatment is less than eight months.

8. The best results occurred when treatment was continued for several years. In these a maximum dose, after apparent cure, is given once every three or four months.

9. Tuberculin is of least value in chronic uveitis, hetero-chromic cyclitis excepted, and most satisfactory in scleritis and periphlebitis retinae.

10. Scleritis, deep and interstitial keratitis, and iridocyclitis are closely related, and may change from one condition to the other.

11. Exudative choroiditis is seldom of tubercular origin, the source of infection often being the teeth.

OCULAR OPERATIONS.

Substitute Operations for Simple Enucleation. The extrusion of the implant in Ténon's capsule when the muscles are tied over it has led to improved methods of suturing the capsule and conjunctiva.

Sweet¹¹⁴ has implanted a metal ball in Ténon's capsule, after excision of the eyeball, in 146 cases with loss of the ball in 4. In the last six years he has had no case of extrusion of the ball and no longer expects one. He claims for his method a very movable stump for the artificial eye, a less marked depression of tissue beneath the brow with consequent less sinking of the artificial eye, and a flat floor of the orbit, much superior to the deep furrowed socket liable to follow simple enucleation. Sweet does not tie the muscles.

Alling¹¹⁵ uses a transplantation of fat from the abdominal wall over which the conjunctiva is closed by a purse-string suture. He no longer ties the muscles over the implant.

Howard¹¹⁶ reports 13 cases of glass ball implantation by Verhoeff's method without a single instance of extrusion. Verhoeff allows the muscle to slip back after severing, suturing the capsule with double armed heavy silk, in such a manner that, after tying, four thicknesses of the capsule are in front of the ball.

Dimitry¹¹⁷ has performed his evisceration and implantation of a gold ball in 20 cases without a single extrusion. After the usual thorough evisceration of the contents of the globe the sclera is cut around the optic nerve by a Graefe knife. The nerve is then severed through this window by curved scissors. The sclera is then evaginated and cleansed of all choroidal tissue, turned back in position, notched anteriorly with scissors in order to facilitate suturing, the gold ball implanted and sutures tied. The conjunctiva is sutured to the capsule of Ténon at its attachment to the globe, thus leaving a loose retrotarsal fold.

The muscles are thus not injured and motion is not impaired.

Grimsdale¹¹⁸ reports the case of retention of the glass ball, which had

¹¹⁴ Archives of Ophthalmology, May, 1919, p. 257.

¹¹⁵ Ibid., May, 1919, p. 262.

¹¹⁶ Ibid., May, 1919, p. 265.

¹¹⁷ American Journal of Ophthalmology, September, 1919, p. 653.

¹¹⁸ British Journal of Ophthalmology, October, 1919, p. 453.

been implanted by Carter in 1888, and the wound closed by a single layer of sutures. In July, 1919, the stump was well covered, movements good, and the patient had always worn a glass shell eye without trouble.

Orbital Anaplerosis. Lagrange¹¹⁹ thus designates his operation for the avoidance of the sinking in of the artificial eye after enucleation. A graft from the temple is made in the following manner: A T-shaped incision is made with the top of the "T" corresponding to the external margin of the orbit and the vertical bar of the "T" extending downward and outward to a point about 1 cm. above the tragus. After the skin is laid back, a piece of the underlying tissue (not too thick because the temple must not be too deformed after the operation) is dissected up about 7 to 8 cm. long, 6 to 7 cm. wide; this is turned on itself leaving a pedicle attached to the skin and the soft parts at the external angle of the orbit. Blunt scissors, and, if necessary, a sound are used to penetrate the orbit under the bridge of skin left at the external angle of the orbit, and also to enter the capsule of Ténon *in the case of a fresh enucleation*. The graft is introduced through this opening by means of forceps. The recti muscles are then sewn together by the retaining stitches placed in them during the enucleation. *In the case of an old enucleation*, in which the muscles and capsule are sunken, the graft is placed in front of and within the muscles and is drawn into place by a suture through its apex which is brought out and tied at the inner end of the upper lid. In either case, it is a simple matter to close the original "T" incision in the skin by sutures.

Epithelial Grafts in Defects of Eyelids. In remedying defects of eyelids, the whole skin-graft with, or without, a pedicle is more or less thick and bulky.

Heckel¹²⁰ prefers an epithelial graft placed in the following manner: An incision is made parallel with, and 3 mm. from, the lid-margin through the skin and scar tissue only, and extending well beyond the point of eversion. The gap is carefully widened until the lid can be pulled up or down as the case may be so that it can be easily stretched as far above the normal line as it was below before operation. The redundancy of the lid-margin is not removed. The stretched lid is then anchored over the other by appropriate sutures, and an epithelial graft, more than sufficiently large to cover the defect, is taken from the arm under proper precautions and laid in position, slightly overlapping the defect. The dressing is left in position seven days unless contra-indicated. If both lids are involved, the operation must be divided.

Snydacker's Blepharoplasty. Before the Chicago Ophthalmological Society, Snydacker¹²¹ reported the case of an epileptic the entire side of whose face, fifteen years ago, had been "virtually fried" when she had fallen on a stove. While Thiersch and Wolfe grafts had taken, they were so distorted that there was no improvement. By beginning at the angle of the jaw, he cut diagonally from the neck a flap 10 inches long, avoiding kinking as much as possible in turning it up. The end of this

¹¹⁹ Arch. d'Opht., March-April, 1919, p. 449.

¹²⁰ Archives of Ophthalmology, July, 1919, p. 311.

¹²¹ American Journal of Ophthalmology, July, 1919, p. 529.

flap was split so that it would cover the upper and lower lids. When this flap had been in place seven or eight days, he cut off a bridge which was not needed because the wound in the neck was easily closed. He has now done this operation four times. Morax has since modified the operation by conserving the bridge thrown away by Snyderker, and later using it in covering the remaining defects. He had done this seven times.

With this operation one should not attempt to replace other methods for slight defects. Almost the only reliable procedures are those with sliding flaps when they can be taken. Even after the flap has "set" it is possible for it to slough when the bridge is cut, whether taken from the neck or from the arm by the Italian method. However, it is worth while in exactly the class of cases for which it was devised by Snyderker in which there is great loss of facial tissue.

Operations for Epiphora. Holmes¹²² believes that removal of the lacrimal gland for epiphora was abandoned because of failure due to faulty technic or want of asepsis. He now extirpates the sac first, closes and seals the wound, and then disinfects the face, especially in the region of the orbit, resterilizing instruments and operators, and only then attacking the gland.

DACRYORHINO CYSTOTOMY. A. Weiner,¹²³ in choosing between the two methods of establishing an artificial opening from the diseased sac into the nose, prefers the external route of Toti over the intranasal method because of its ease of accomplishment and the open, clear view of the field of operation. After operation, he continues gentle probing two or three times weekly for a month or two, watching the opening into the nose to prevent its closure and cauterizing granulations around it.

Fischer¹²⁴ has performed Toti's operation 23 times. Seventeen of the 23 cases were attributed to the condition of the nose particularly the ethmoidal region. This proportion agrees with the findings of Kuhnt, Brunzlo, Rhese and Shuster, but differ from those of West who found nasal involvement only rarely in 480 cases of tear-sac disease.

OPERATION FOR THE REMOVAL OF THE LACRIMAL SAC. A. Duhamel¹²⁵ avoids hemorrhage, which so frequently annoys the operator following the usual methods, by making a horseshoe incision $1\frac{1}{2}$ mm. to 2 mm. deep, between the caruncle and the free edge of the lids extending to just below the lacrimal puncta.

The incision made by a small "detache-tendon" frees without effort the upper and lower portions of the sac. Attacking in the same manner the middle region of the sac, the operation, at the point of contact with the lower surface of the tendon of the orbicularis, is arrested by a resistance due to the reflected tendon and to the canal of union, which must be cut by a stroke of the scissors $\frac{1}{2}$ blunt. The sac is uncovered by retractors placed on the parts within the lids. A tampon of adrenalin permits dissection of the sac without hemorrhage. The opening of the

¹²² Archives of Ophthalmology, July, 1919, p. 323.

¹²³ Ibid., p. 334.

¹²⁴ Zeitschrift f. Augenh., 1918, xxxix, p. 1.

¹²⁵ Annales d'Oculist., February, 1919, No. 2, clvi, p. 107.

nasal canal is lightly cauterized and gauze is placed for drainage in the bed of the sac.

Sarcoma of the Iris Removed by Iridectomy. Friedenwald¹²⁶ says that Laven¹²⁷ had found, in 1913, 130 cases on record of primary sarcoma of the iris.

His own case, aged forty years, was normal when first seen in 1909 and in 1915; but in 1917 the patient came for a change in glasses, and her vision was normal, but the ophthalmoscope showed slight distortion of the left pupil. The loupe showed a small pinkish mass, 2 mm. in diameter protruding into the anterior chamber from the nasal part of the iris, midway between the pupil and periphery. In May, a broad iridectomy, including the growth, was accomplished. Examination revealed a spindle-cell sarcoma almost free from pigment. No recurrence in one and a half years.

This case suggests what would have happened to the patient if she had always been a patient of an optician—"Optometrist," also the comparative safety of removing tumors of the iris when vision is normal; whether there is anything in the theory of extension of tumors as well as inflammation in the direction of the blood stream, the fact remains that more malignant growths are removed from the iris without recurrence than from any other part of the eye.

¹²⁶ American Journal of Ophthalmology, July, 1919, p. 523

¹²⁷ Klin. Monatsbl. f. Augh., vol. li, p. 493.

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